

**UNITED STATES DISTRICT COURT  
NORTHERN DISTRICT OF CALIFORNIA  
OAKLAND DIVISION**

EPIC GAMES, INC.,

*Plaintiff*

v.

APPLE INC.,

*Defendant.*

No. 4:20-CV-05640-YGR

**DECLARATION OF LORIN M. HITT, PH.D.**

September 15, 2020

## Table of contents

<b>1. Introduction .....</b>	<b>3</b>
1.1. Qualifications.....	3
1.2. Parties.....	5
1.3. Summary of allegations .....	5
1.4. Assignment.....	6
<b>2. Summary of opinions.....</b>	<b>7</b>
<b>3. Epic’s market definition improperly excludes numerous platforms that Epic can and does use to distribute Fortnite to gamers .....</b>	<b>8</b>
3.1. Developers like Epic can and do distribute videogames like Fortnite across multiple platforms.....	9
3.2. Market participant behavior demonstrates that the relevant antitrust market is broader than iOS or even smartphone app distribution.....	15
3.3. Dr. Evans’ switching costs analysis is fatally flawed and uninformative .....	17
<b>4. Apple does not possess monopoly power.....</b>	<b>20</b>
4.1. Apple has a low share of a properly defined relevant antitrust market.....	20
4.2. Epic has alternative monetization options both within and outside iOS .....	22
4.3. Apple’s commission is not supracompetitive and does not support Epic’s claim that Apple possesses monopoly power.....	23
<b>5. Apple’s procompetitive business strategy generates substantial surplus for developers and consumers, which Epic’s proposals would put at risk .....</b>	<b>27</b>
5.1. The App Store business model generates multiple benefits for developers and consumers.....	27
5.2. Epic’s alternative monetization suggestions for Apple are severely flawed and likely to harm consumers and developers, as well as stifle innovation in the App Store .....	32

## 1. Introduction

### 1.1. Qualifications

1. My name is Lorin Moultrie Hitt. I am the Zhang Jindong Professor of Operations, Information and Decisions at the University of Pennsylvania, Wharton School.

2. As a faculty member in the Operations, Information and Decisions Department, my research and teaching focus on the economics of the information technology industry and related industries, with a specific emphasis on firms engaged in or affected by Internet-based commerce. For instance, I have conducted research on pricing and competition among online travel agents, the effect of product recommendation services on consumer choice and product price, customer loyalty to online brokers (and online businesses more broadly), consumer behavior in online services such as banking and healthcare, and the economic impact of social media services such as Facebook and Twitter. More broadly, my research encompasses both theoretical modeling and empirical analysis of pricing, marketing, competition, and consumer behavior in online markets. I have published more than 35 peer-reviewed articles in top-tier economics and management journals such as the *Quarterly Journal of Economics*, the *Review of Economics and Statistics*, the *Journal of Economic Perspectives*, *Management Science*, *Information Systems Research*, as well as more than two dozen other publications in books, trade journals, and other practice-oriented outlets. About a third of my published work in academic journals relates to pricing or consumer behavior, with most of the rest focusing on the economic value of information technology and factors that affect that value.

3. I previously held senior editorial positions at three major research journals: *Management Science* (former Department Editor), *Information Systems Research* (former Senior Editor), and *Journal of Management Information Systems* (Editorial Board member). I have also been a reviewer for the *American Economic Review*; the *Quarterly Journal of Economics*; *Information Economics and Policy*; *Journal of Industrial Economics*; *Journal of Law, Economics, and Organization*; *Managerial and Decision Economics*; *Marketing Science*; *Review of Economics and Statistics*; *Sloan Management Review*; and the National Science Foundation, among others. I have twice served on the program committee for the Workshop on Information Systems and Economics, the primary conference in my sub-discipline.

4. I have taught undergraduate, masters, doctoral, and executive education level courses at the University of Pennsylvania and the Massachusetts Institute of

Technology on competition and customer pricing in a variety of commercial and consumer markets, information systems management, electronic commerce, information economics, data analysis, and methodologies used to understand the impact of information technology investments and strategies on firms, consumers, and markets. I created one of the first courses in the economics of electronic commerce (first offered in 1998) and taught that course for over 16 years, and I continue to cover similar material in my Ph.D. seminar along with theoretical and empirical methods used in economic research and their application to the study of online markets. I also designed the Wharton Undergraduate Managing Electronic Commerce concentration. I am an eleven-time award winner of the undergraduate excellence in teaching award and have also won the Wharton-wide Hauck Award, and the University-wide Lindback Award for teaching.

5. I received my Ph.D. in Management from the Massachusetts Institute of Technology Sloan School of Management in 1996 and my Sc.B. (1988) and Sc.M. (1989) degrees in Electrical Engineering from Brown University. Before receiving my Ph.D., I worked as an engineer developing software and hardware for microprocessor testing (for Harry Diamond Laboratories, United States Army), as a researcher in semiconductor fabrication and design (for Brown University and the IBM Thomas J. Watson Research Center), and as a management consultant (for Oliver, Wyman and Company).

6. I have been retained as an expert witness on matters involving smartphones, tablets, laptops, other mobile devices, and personal computers as well as the underlying technologies within these products such as microprocessors, LCD displays, memory devices, and communications chipsets. I have also worked on issues related to pricing and competition in a variety of software products including security software, database products, content creation software, and operating systems. I have been previously involved in antitrust litigation related to an alleged price-fixing conspiracy in LCD displays and the effects of such conspiracy on wholesale and retail prices<sup>1</sup> and an antitrust case against Microsoft in which I evaluated competition in operating systems and complementary products prior to and during the period when smartphones were first introduced.<sup>2</sup> My curriculum vitae, which lists my academic publications, is attached as Appendix A.

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<sup>1</sup> In re: TFT-LCD (Flat Panel) Antitrust Litigation, U.S. District Court, Northern District of California.

<sup>2</sup> Prosys Consultants, Ltd and Neil Godfrey v. Microsoft Corporation and Microsoft Canada Co./Microsoft Canada CIE. Supreme Court of British Columbia, Vancouver Registry No. L043175.

## **1.2. Parties**

7. Apple is a publicly traded technology company founded in 1976 that designs and develops the hardware and software for personal computers (“Macs”), mobile phones (“iPhones”), and other devices, including tablets and watches (“iPads” and “Apple Watches”). Apple also offers a range of services and software in its ecosystem including network solutions, applications, and third-party digital content.<sup>3</sup> In particular, Apple created the “App Store,” a platform available to both application developers and consumers which allows iPad and iPhone users to find and download safe to use applications for use on their devices.<sup>4</sup>

8. Epic Games (“Epic”) is a video game developer that was founded in 1991. Its popular games include Fortnite, Unreal, Gears of War, Shadow Complex, and the Infinity Blade series.<sup>5</sup> Epic also provides a 3D game development tool called the “Unreal Engine,” for use in developing games for personal computers, consoles, mobile devices, the web, and other platforms.<sup>6</sup> Epic also runs the Epic Games Store, a digital storefront for PC and Mac that became available December 2018.<sup>7</sup>

## **1.3. Summary of allegations**

9. On August 13, 2020, Epic filed a Complaint for Injunctive Relief against Apple.<sup>8</sup> The Complaint alleges that Apple “maintains a complete monopoly over the iOS App Distribution Market,”<sup>9</sup> and that “There is a relevant market for the processing of payments for the purchase of digital content, including in-game content, that is consumed within iOS apps, the iOS In-App Payment Processing Market.”<sup>10</sup> Epic makes various monopolization and restraint of trade claims in these alleged markets.

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<sup>3</sup> Reuters, “About Apple Inc.,” available at <https://www.reuters.com/companies/AAPL.O>, accessed on September 7, 2020.

<sup>4</sup> Apple, “App Store,” available at <https://www.apple.com/ios/app-store/principles-practices/>, accessed on September 7, 2020.

<sup>5</sup> Epic Games, “Company,” available at <https://www.epicgames.com/site/en-US/about>, accessed on September 7, 2020.

<sup>6</sup> Unreal Engine, “Features,” available at <https://www.unrealengine.com/en-US/features>, accessed on September 12, 2020.

<sup>7</sup> Epic Games, “The Epic Games Store is now live,” available at <https://www.epicgames.com/store/en-US/news/the-epic-games-store-is-now-live>, accessed on September 14, 2020.

<sup>8</sup> Complaint for Injunctive Relief, *Epic Games, Inc. vs. Apple Inc.*, August 13, 2020 (“Complaint”).

<sup>9</sup> Complaint, ¶ 35.

<sup>10</sup> Complaint, ¶ 109.

10. In its Motion for Preliminary Injunction filed on September 4, 2020, Epic further argued that “Apple’s monopoly power in the iOS App Distribution Market is the foundation of its misconduct in both markets,” and that “direct evidence proves that the App Store and IAP are separate.”<sup>11</sup> Epic’s principal theory is that Apple has engaged in an anticompetitive “tying” arrangement linking iOS distribution services (the “tying” product) with iOS In-App Payment Processing services (the “tied” product).

#### **1.4. Assignment**

11. Counsel for Apple have asked me to address questions on a number of topics related to Epic’s motion for a preliminary injunction.

- Assess the claim that the alleged iOS App Distribution market is a relevant antitrust market.
- Assess the claim that Apple possesses monopoly power in the relevant antitrust market and the available evidence on whether Apple’s commission is supracompetitive.
- Assess the competitive effects of Apple’s App Store business model and the likely impact of Epic’s proposals that Apple monetize the App Store through alternative fees.

12. My work on this matter is ongoing. The analysis and opinions in this declaration are based on the work I have done to date and the information that is available to me at this time. I have identified in this Declaration the information and data that I have relied on in forming my opinions. Among other things, I have not yet had access to the underlying calculations and data referenced in the September 4, 2020 Declaration of Tim Sweeney (“Sweeney Declaration”) or in the September 4, 2020 Declaration of David Evans (“Evans Declaration”). I reserve the right to revise or supplement my opinions as that or any other relevant information becomes available.

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<sup>11</sup> Plaintiff Epic Games, Inc.’s Notice of Motion and Motion for a Preliminary Injunction and Memorandum of Points and Authorities in Support Thereof, *Epic Game, Inc. vs. Apple Inc.*, September 4, 2020 (“Epic Motion for Preliminary Injunction”), pp. 12:8–9, 17:2–3.

## **2. Summary of opinions**

13. I have reached the following key conclusions.

14. On the question of market definition, I address some of the ways in which Epic's and Dr. Evans' market definition approach is flawed. I find that the App Store is not the only distribution channel for games in general or for Fortnite in particular. I therefore conclude that the relevant market cannot be limited to the distribution of iOS apps, and must at least include competing platforms on which Epic already distributes and monetizes Fortnite (§§ 3.1–3.2). Dr. Evans' switching costs analysis is fatally flawed and insufficient to support his inappropriately narrow market definition, because it focuses on the irrelevant question of whether consumers would switch from iOS to Android, instead of asking whether consumers are able to play Fortnite on different platforms (§ 3.3).

15. On the question of market power, I conclude that Epic and Dr. Evans are wrong to assert that Apple is a monopoly with a 100 percent share of the relevant antitrust market. The properly defined relevant antitrust market at issue is at least broad enough to include other major platforms on which Fortnite is distributed and monetized. Apple lacks monopoly power within such a market, with its share in such a market being low, between roughly 10 and 20 percent depending on the measure used. Epic has leveraged Apple's low share in negotiations with Apple to obtain greater levels of support and other non-price concessions (§ 4.1). Moreover, Epic has alternative monetization options, both within and outside of iOS, which constrain Apple's ability to exercise market power (§ 4.2). Finally, there is no evidence that Apple's commission is supracompetitive, contradicting allegations that Apple is a monopolist in the relevant antitrust market (§ 4.3).

16. On the question of competitive effects, I note that Dr. Evans does not appear to claim that Apple has raised prices, lowered quality, engaged in anticompetitive behavior, or otherwise harmed consumers. On the contrary, Apple's App Store business strategy has led to large procompetitive benefits for developers and consumers (§ 5.1). I also conclude that the alternative monetization methods that Epic has suggested are likely to disrupt the App Store ecosystem to the detriment of consumers, developers, and the platform (§ 5.2).

### **3. Epic's market definition improperly excludes numerous platforms that Epic can and does use to distribute Fortnite to gamers**

17. The goals of market definition are to help specify the line of commerce in which competitive concerns may arise, help identify market participants, and help measure market shares and concentration.<sup>12</sup> Market definition is an inquiry that focuses on customer choices, namely “customers’ ability and willingness” to switch to alternatives if faced with a small but significant price increase or quality decrease.<sup>13</sup> A market is too narrow if customers have enough alternatives outside of the market that completely eliminating competition within the market would not lead to significant harm.<sup>14</sup>

18. Defining relevant antitrust markets in the present case therefore requires that one evaluates the options that Epic and other developers (the customers) have in distributing and monetizing Fortnite and other videogames. Dr. Evans has failed to undertake this necessary analysis. His analysis focuses instead entirely on smartphones, devoting considerable attention to establishing that there are a limited number of smartphone platforms and that most smartphone app distribution occurs through the providers of these platforms.<sup>15</sup> His analysis fails to examine whether videogame developers like Epic have alternative distribution and monetization options that would substantially limit the ability of Apple or other smartphone platform owners to exercise monopoly power.<sup>16</sup>

19. It is clear that videogame developers do have such options. The App Store is not the only distribution channel for games in general or for Fortnite in particular. Epic distributes and monetizes Fortnite on a variety of platforms. As I explain in the rest

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<sup>12</sup> U.S. Department of Justice and the Federal Trade Commission, “Horizontal Merger Guidelines,” August 19, 2010, available at <https://www.ftc.gov/sites/default/files/attachments/merger-review/100819hmg.pdf>, accessed on September 12, 2020 (“Horizontal Merger Guidelines”), § 4 (“First, market definition helps specify the line of commerce and section of the country in which the competitive concern arises. In any merger enforcement action, the Agencies will normally identify one or more relevant markets in which the merger may substantially lessen competition. Second, market definition allows the Agencies to identify market participants and measure market shares and market concentration.”).

<sup>13</sup> Horizontal Merger Guidelines, § 4 (“Market definition focuses solely on demand substitution factors, i.e., on customers’ ability and willingness to substitute away from one product to another in response to a price increase or a corresponding non-price change such as a reduction in product quality or service.”).

<sup>14</sup> Horizontal Merger Guidelines, § 4 (“However, a group of products is too narrow to constitute a relevant market if competition from products outside that group is so ample that even the complete elimination of competition within the group would not significantly harm either direct customers or downstream consumers.”).

<sup>15</sup> For example, see Evans Declaration, ¶ 16 (“Nowadays, almost all smartphones have software platforms provided by Apple (iOS) or Google (Android). These two companies accounted for the software platforms installed on nearly all smartphones sold between 2016 and 2020.”). See also ¶¶ 13, 25, 27, 29, 49.

<sup>16</sup> My conclusions on market definition and market power are based on the analysis of competition regarding Fortnite and Epic Games specifically, and do not address competitive conditions affecting other apps and app types, which will likely be specific to each app.



of this section, it is improper for Dr. Evans to simply exclude these alternatives from the relevant antitrust market.

### ***3.1. Developers like Epic can and do distribute videogames like Fortnite across multiple platforms***

20. It is natural to begin an inquiry into market definition by considering the alternatives available to customers. Epic's allegations are related to the distribution and monetization of Fortnite on iOS, therefore it is natural to ask whether Epic has alternative ways to distribute and monetize Fortnite. Dr. Evans does not ask this question. He largely ignores developers' ability to distribute and monetize their videogames on multiple platforms commonly used to play videogames, such as Microsoft Windows PCs ("PC"), Microsoft's Xbox One, Sony's PlayStation 4 ("PS4"), the Nintendo Switch, Apple macOS computers ("Mac"),<sup>17</sup> and tablets (both Android-based and Microsoft's Surface series).<sup>18</sup> Developers can also make their games available on game streaming platforms, such as GeForce Now, which consumers can access on various hardware.<sup>19</sup> In addition to smartphones and tablets, Epic makes Fortnite available on each of the above platforms.<sup>20</sup> As Epic's own experience with

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<sup>17</sup> My support staff confirmed that, as of September 14, 2020, Fortnite is still downloadable on macOS computers. The Fortnite download page still offers separate downloads for PC, Mac, and Android, and they were able to install and launch Fortnite on macOS. Once launching the game, however, a prominent in-game message informs the player that "Apple has blocked your ability to update Fortnite on the App Store, and has said they will terminate our ability to develop Fortnite for Apple devices. As a result, Chapter 2 – Season 4 (v14.00) is unavailable on your device."

<sup>18</sup> Dr. Evans mentions that some apps are available for gaming consoles, but that many consumers do not own a console or may not have convenient access to a console for parts of the day. Evans Declaration, ¶¶ 26, 41 ("Many of these consumers do not own one of these other devices and some can't afford to do so. In addition, the consumers who do have these alternative devices may not have access, or convenient access, to these devices, for parts of their days when they want to use applications."). Epic acknowledges that Fortnite on average only has 2.5 million daily active users on iOS (Sweeney Declaration, ¶ 3), yet it does not appear to have disclosed how many of these users play Fortnite exclusively on iPhone. Given that the PS4, Switch, and Xbox One have respectively sold more than 110, 62, and 50 million consoles, and that there are 95 million active monthly accounts on the Steam platform (as a proxy for PCs that are used for gaming), it is highly likely that many of the 2.5 million Fortnite daily active users on iOS have access to a console or PC. See: "Supplemental Information for the Consolidated Financial Results for the Fourth Quarter Ended March 31, 2020," May 13, 2020, available at [https://www.sony.net/SonyInfo/IR/library/presen/er/pdf/19q4\\_supplement.pdf](https://www.sony.net/SonyInfo/IR/library/presen/er/pdf/19q4_supplement.pdf), accessed on September 14, 2020; Liam Doolan, "Yep, The Switch Has Now Outsold The NES," *nintendolife*, August 14, 2020, available at [https://www.nintendolife.com/news/2020/08/yep\\_the\\_switch\\_has\\_now\\_outsold\\_the\\_nes](https://www.nintendolife.com/news/2020/08/yep_the_switch_has_now_outsold_the_nes), accessed on September 14, 2020; Paul Tassi, "The Nintendo Switch May Have Just Outsold the Xbox One With 3.5 Year Late Start," *Forbes*, available at <https://www.forbes.com/sites/paultassi/2020/01/30/the-nintendo-switch-may-have-just-outsold-the-xbox-one-with-a-35-year-late-start/#337900a557e5>, accessed on September 14, 2020; and <https://steamcommunity.com/groups/steamworks/announcements/detail/1697229969000435735>, accessed on September 14, 2020.

<sup>19</sup> Sean Hollister, "Nvidia's GeForce Now is finally out of beta, challenges Google Stadia at \$5 a month," *The Verge*, February 4, 2020, available at <https://www.theverge.com/2020/2/4/21121996/nvidia-geforce-now-2-0-out-of-beta-rtx>, accessed on September 14, 2020.

<sup>20</sup> Sweeney Declaration, ¶ 3 ("[Fortnite] is available for Microsoft Windows, macOS, PlayStation 4, Xbox One, and Nintendo Switch.").

Fortnite demonstrates, it is inappropriate to simply exclude these alternatives from the relevant antitrust market, as Dr. Evans has done.

*3.1.1. Fortnite's multi-platform release serves as a powerful example of the many distribution options available to videogame developers*

21. Fortnite's user growth has been rapid and began outside of iOS and, more generally, outside of mobile devices (smartphones and tablets). Fortnite's original game mode, "Save the World," launched on PC, Mac, PS4, and Xbox One on July 25, 2017. This mode allowed players in small teams to compete against computer generated opponents and met with modest success.<sup>21</sup> By August 2017, Fortnite had only 1 million users.<sup>22</sup> Shortly after, on September 26, 2017, Epic Games introduced what would eventually become the main mode of the game, Battle Royale, which enabled 100 players to compete against each other. Battle Royale was free to play.<sup>23</sup> After launching Battle Royale, the game quickly became more popular. By December 2017 the user base had grown to an estimated 30 million unique users.<sup>24</sup> By January 2018 it was reported to have grown to 45 million.<sup>25</sup>

22. Fortnite was therefore already available on several platforms and had tens of millions of players before it launched on iOS in March 2018. With technical and

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<sup>21</sup> Fortnite, "When Does Save The World Become Free?" *GameWith*, May 8, 2019, available at <https://gamewith.net/fortnite/article/show/480>, accessed on September 12, 2020; Matthew Kato, "Fortnite's Save The World Mode Not Going Free To Play In 2018," *Game Informer*, October 22, 2018, available at <https://www.gameinformer.com/2018/10/22/fortnites-save-the-world-mode-not-going-free-to-play-in-2018>, accessed on September 12, 2020.

<sup>22</sup> Christina Gough, "Number of registered users of Fortnite worldwide from August 2017 to May 2020," *Statista*, available at <https://www.statista.com/statistics/746230/fortnite-players/> ("Statista – Fortnite Users"), accessed on September 7, 2020.

<sup>23</sup> Fortnite @FortniteGame, "Download Fortnite Battle Royale for free now: PC: Fortnite.com PS4: PS Store goo.gl/BGQ3u7 Xbox One: Later Today," *Twitter*, September 26, 2017, available at <https://twitter.com/FortniteGame/status/912668502644920321>, accessed on September 9, 2020.

<sup>24</sup> James Brightman, "Fortnite passes 30m players with a focus on rapid updates," December 8, 2017, available at <https://www.gamesindustry.biz/articles/2017-12-08-fortnite-passes-30m-players-with-a-focus-on-rapid-updates>, accessed on September 15, 2020.

<sup>25</sup> Scott Duwe, "Fortnite: Battle Royale has hit a milestone of 45 million players," January 17, 2018, available at <https://www.gamepur.com/news/fortnite-battle-royale-45-million-players>, accessed on September 15, 2020.

marketing support from Apple,<sup>26</sup> Fortnite's successful launch on iOS contributed to its reaching 125 million users by June 2018.<sup>27</sup>

23. iOS was not the last platform on which Epic released Fortnite. In June 2018, on the day Epic announced it had 125 million users, Fortnite also launched on the Nintendo Switch.<sup>28</sup> By October 2018, Fortnite had been installed on "nearly half" of all Nintendo Switch systems.<sup>29</sup> Epic also began the rollout of Fortnite to Android devices in July 2018, starting with the Nvidia Shield – a hybrid smart TV and gaming system.<sup>30</sup> Following the Shield release, Fortnite was launched exclusively on select Samsung Galaxy mobile Android devices on August 9, 2018.<sup>31</sup> Epic then released Fortnite to the rest of Android mobile devices six days later.<sup>32</sup> Epic decided not to list Fortnite on the Google Play store and instead offered the app for direct download, otherwise known as "sideloading."<sup>33</sup> After a year and a half, on April 21, 2020, Epic

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<sup>26</sup> Schmid Declaration, ¶¶ 5–6, 9 ("With Apple's support, *Fortnite* has grown into an incredibly successful iOS app, enjoying nearly 130 million iOS downloads globally.... Apple's support of Epic began even before the initial iOS launch of *Fortnite* in March 2018, which occurred through a region-by-region, invite-only user system.... In addition to providing engineering, technical, and hardware-related support, Apple has also provided Epic with an extraordinary amount of marketing and promotion support for *Fortnite*—again, as much as Apple has provided to any other game in recent history.").

<sup>27</sup> Christina Gough, "Number of registered users of Fortnite worldwide from August 2017 to May 2020," *Statista*, available at <https://www.statista.com/statistics/746230/fortnite-players/>, accessed on September 7, 2020.

<sup>28</sup> Nick Statt, "Fortnite now has 125 million players just one year after launch," *The Verge*, June 12, 2018, available at <https://www.theverge.com/2018/6/12/17456814/fortnite-battle-royale-epic-games-125-million-players-first-year-e3-2018>, accessed on September 9, 2020.

<sup>29</sup> Andrew Webster, "Fortnite has been installed on 'nearly half' of all Nintendo Switch systems," *The Verge*, October 31, 2018, available at <https://www.theverge.com/2018/10/31/18047958/fortnite-nintendo-switch-downloads>, accessed on September 9, 2020.

<sup>30</sup> NVIDIA SHIELD, "#Fortnite Season 5 is live and available to play on #GeForceNOW. Here's everything you need to know!," *Twitter*, July 12, 2018, available at <https://twitter.com/NVIDIASHIELD/status/1017463526720458752>, accessed on September 9, 2020.

<sup>31</sup> Samsung Newsroom U.S., "Starting Now, Galaxy Users Will Have Advanced Access to Fortnite Beta on Android," August 9, 2018, available at <https://news.samsung.com/us/starting-now-galaxy-users-advance-access-fortnite-beta-android/>, accessed on September 9, 2020.

<sup>32</sup> C. Scott Brown, "Fortnite on Android: All the info on its unconventional release (Updated: August 9)," *Android Authority*, August 10, 2018, available at <https://www.androidauthority.com/fortnite-release-date-android-892804/>, accessed on September 9, 2020.

<sup>33</sup> Rachel Kaser, "Fortnite won't be on Google Play, so here's how Android users can get it," *TNW*, August 3, 2018, available at <https://thenextweb.com/gaming/2018/08/03/fortnite-google-play-android-users/>, accessed on September 9, 2020. Sideload is the process of installing an app on an android device from anywhere other than an official App Store. See Lori Grunin and Sean Hollister, "Fortnite for Android: Epic tells us why it won't be on Google's Play Store," *c|net*, August 3, 2018, available at <https://www.cnet.com/news/want-fortnite-for-android-you-wont-get-it-from-the-google-play-store/>, accessed on September 9, 2020.

eventually decided to list Fortnite on the Google Play store.<sup>34</sup> Epic then announced in May 2020 that Fortnite users had increased to 350 million.<sup>35</sup>

24. Thus, Epic has the option to distribute its games through many competing platforms and has exercised this option by providing Fortnite on numerous platforms. Epic has and will continue to have the ability to shift their game development and monetization effort across these platforms and consumers have multiple options upon which to play Fortnite.

*3.1.2. Fortnite's "cross-play" capabilities illustrate that consumers seamlessly play videogames on multiple platforms, facilitating distribution alternatives*

25. Consumers' ability and willingness to play Fortnite and other videogames across multiple platforms facilitates Epic's ability to switch away from a platform that increases price or reduces quality. This reinforces the conclusion that it is inappropriate to exclude the other platforms on which Fortnite is available from the relevant antitrust market.

26. Consumers not only have their choice of platform on which to play Fortnite, they also have the ability to switch between platforms with limited frictions, as their in-game progress follows them from one platform to the next. Furthermore, Fortnite is also "cross-play," meaning that consumers can play with or against players on any other platform, so they can switch platforms without affecting their ability to play with certain other players.<sup>36</sup>

27. Fortnite players are therefore not "locked in" to any platform and can freely switch between the various platforms on which Fortnite is available. Indeed, many consumers play on non-iOS platforms or multiple platforms. For example,

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<sup>34</sup> Brendan Sinclair, "Epic relents, puts Fortnite on Google Play," *gamesindustry.biz*, April 21, 2020, available at <https://www.gamesindustry.biz/articles/2020-04-21-epic-relents-puts-fortnite-on-google-play>, accessed on September 9, 2020.

<sup>35</sup> Christina Gough, "Number of registered users of Fortnite worldwide from August 2017 to May 2020," *Statista*, available at <https://www.statista.com/statistics/746230/fortnite-players/>, accessed on September 7, 2020.

<sup>36</sup> Cross-play is the ability of players using different video game hardware (i.e. a personal computer, game system, or mobile device) to simultaneously play with each other. See GameCentral, "What is PS4 crossplay and what games use it?" *Metro*, October 3, 2019, available at <https://metro.co.uk/2019/10/03/ps4-crossplay-games-use-10855264/>, accessed on September 12, 2020.

- According to Epic, only 21 percent of Fortnite’s total registered users have played exclusively on iOS,<sup>37</sup> and iOS players represent an even smaller share of Fortnite’s average daily players through August 13, 2020 – “nearly 10 percent” according to Epic.<sup>38</sup>
- A survey shows that a majority of players of Battle Royale games (the category of games that includes Fortnite) have played on more than one platform.<sup>39</sup>

28. Playing across platforms was not immediately an option for Fortnite across all platforms. Initially, consumers playing a game on the Sony PlayStation could not move their progress to the Xbox, or play with their friends that were using an Xbox and vice versa.<sup>40</sup> Epic successfully pressured console developers to change this, with Nintendo and Microsoft agreeing to “cross-play” in June 2018.<sup>41</sup> Sony took longer to relent and allowed cross-play between the PS4 and the Xbox One and the Switch in September 2018.<sup>42</sup> Following these agreements, Fortnite achieved 200 million users by November 2018 and 250 million by March 2019.<sup>43</sup> Unlike other platforms, Apple supported “cross-play” on iOS from day one.<sup>44</sup>

29. Consumers’ ability and willingness to play Fortnite across multiple platforms facilitates Epic’s ability to switch away from distributing on a platform that increases price or reduces quality. The fact that Fortnite is both multiplatform and cross-play facilitates this switch because it limits the frictions (such as compatibility constraints

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<sup>37</sup> Out of Fortnite’s more than 350 million registered users, 116 million registered users have accessed Fortnite on an iOS device. However, 37% of those have also accessed Fortnite on other platforms. Sweeney Declaration, ¶ 3.

<sup>38</sup> Sweeney Declaration, ¶ 3 (“From the time Fortnite launched on iOS through August 13, 2020, it averaged 2.5 million daily iOS players, representing nearly 10% of Fortnite’s total average daily players.”).

<sup>39</sup> 56% of Battle Royale players have played on two or more platforms. See Stijn Wernars, “Newzoo’s Battle Royale Sentiment Study: Understanding the Phenomena and What Draws Players to Particular Franchises,” *Newzoo*, July 11, 2019, available at <https://newzoo.com/insights/articles/newzoos-battle-royale-sentiment-study-understanding-the-phenomena-and-what-draws-players-to-particular-franchises/>, accessed on September 10, 2020.

<sup>40</sup> Tom Warren, “Microsoft reveals Sony is blocking Fortnite PS4 vs. Xbox One cross-play,” *The Verge*, March 12, 2018, available at <https://www.theverge.com/2018/3/12/17111546/microsoft-sony-fortnite-cross-play-ps4-xbox-one>, accessed on September 9, 2020.

<sup>41</sup> Sarah E. Needleman, “Tech: The Man Behind ‘Fortnite,’” *The Wall Street Journal*, June 15, 2019, available at <https://www.wsj.com/articles/the-man-behind-fortnite-11560571201>, accessed on September 9, 2020.

<sup>42</sup> Becca Caddy, “Sony finally enables Fortnite cross-play for PS4,” *techradar*, September 26, 2018, available at <https://www.techradar.com/news/sony-finally-enables-fortnite-cross-play-for-ps4#:~:text=According%20to%20Sony%2C%20an%20open,maintain%20a%20good%2Dquality%20experience,> accessed on September 9, 2020.

<sup>43</sup> Christina Gough, “Number of registered users of Fortnite worldwide from August 2017 to May 2020,” *Statista*, available at <https://www.statista.com/statistics/746230/fortnite-players/>, accessed on September 7, 2020.

<sup>44</sup> For example, see Michael McWhertor, “Fortnite mobile invites are going out now,” *Polygon*, March 15, 2018, available at <https://www.polygon.com/2018/3/15/17126798/fortnite-battle-royale-mobile-invite-ios-epic-games-app-store-first-wave>, accessed on September 8, 2020. This contrasts to the Sony PlayStation, which initially resisted cross-play. See Tom Warren, “Sony enabling Fortnite cross-play for PS4 against Xbox and Switch,” *The Verge*, September 26, 2018, available at <https://www.theverge.com/2018/9/26/17905146/sony-fortnite-ps4-cross-play-support>, accessed on September 8, 2020.



or network effects) that would inhibit the ability of consumers to move. Epic is then free to invest in competing platforms regardless of where its current installed base resides.

*3.1.3. Fortnite demonstrates how developers can monetize their games across platforms, further facilitating their ability to switch to alternative distribution options*

30. Epic generates revenue from Fortnite principally through the sale of digital products for use within the game. These products are entirely cosmetic and do not provide any advantage in gameplay. For example, they affect the player's appearance (playing as new characters or wearing "skins" that alter the appearance of existing characters) or provide other non-competitive functionality (e.g., dances). Epic also provides a "Battle Pass" that creates new options for acquiring such digital content.

31. Players acquire these items using "V-Bucks," an in-game currency that can be purchased in a variety of channels. V-Bucks were historically made available at a conversion rate of \$1.00 for 100 V-Bucks.<sup>45</sup> In kicking off this dispute, however, Epic has instituted a 20 percent price decrease (on all platforms) to a conversion rate of \$0.80 for 100 V-Bucks.<sup>46</sup> The prices of the "skins" and dances within Fortnite vary significantly. For example, under the discounted prices available on September 12, 2020, the well-known dance "Twist" was available for 500 V-bucks (\$4), while the skin "Moisty Merman" was available for 2,000 V-bucks (\$16).

32. V-Bucks purchased on one platform (e.g. Xbox One or iOS) can generally be used to purchase items on other platforms. Once an item is purchased using V-Bucks, it can be used across any platform regardless of where the original purchase was made.<sup>47</sup> Thus, Epic is not constrained to monetize Fortnite on a particular platform. Developers' ability to monetize their videogames across platforms makes it easier for

<sup>45</sup> See, for example, Akhilesh Ganti, "How Does Fortnite Make Money?" *Investopedia*, March 27, 2020, available at <https://www.investopedia.com/tech/how-does-fortnite-make-money/#:~:text=Although%20there%20are%20special%20deals,dollar%20to%20100%20V%2DBucks.>, accessed on September 9, 2020 ("...the exchange rate is roughly one U.S. dollar to 100 V-Bucks"). Just prior to this litigation, Epic began offering a 20% discount on V-Bucks, apparently for the first time.

<sup>46</sup> Andrew Webster, "Epic offers new direct payment in Fortnite on iOS and Android to get around app store fees," available at <https://www.theverge.com/2020/8/13/21366259/epic-fortnite-vbucks-mega-drop-discount-iphone-android>, accessed on September 15, 2020 ("Today, Epic announced the Fortnite "mega drop," a permanent discount on V-bucks and other cash purchases in the game of up to 20 percent. ... If you purchase V-bucks or anything else in the game through either the App Store or Google Play Store, it will cost the same as always. But the new direct option comes with the discount....").

<sup>47</sup> V-bucks purchased on Nintendo Switch or PlayStation 4 can only be used on the original platform, but any purchases on these platforms are available to use across all platforms. See Epic Games, "FAQ," August 17, 2020, available at <https://www.epicgames.com/fortnite/en-US/faq>, accessed on September 7, 2020 ("V-Bucks purchased on Nintendo Switch and PlayStation 4 can only be spent on the platform they were purchased on. All other V-Bucks purchases are available across platforms, and all purchased items can be accessed across platforms you play Fortnite on.").

them to switch away from a distribution platform that increases its price or reduces its quality.

**3.2. Market participant behavior demonstrates that the relevant antitrust market is broader than iOS or even smartphone app distribution**

33. The currently available evidence on consumers' Fortnite gaming habits further demonstrates that it is improper for Dr. Evans to simply exclude the numerous alternative platforms on which Fortnite is available. Moreover, Epic's actions surrounding the present dispute are consistent with a belief that consumers are not locked into a single platform and that they can and do play across multiple platforms. These behaviors of both gamers and Epic strengthen my conclusion that the relevant antitrust market is broader than that asserted by Dr. Evans.

*3.2.1. Only a minority of Fortnite's users play exclusively on iPhones and iPads, consistent with a broader relevant antitrust market*

34. Epic has the ability to reach the majority of its existing customer base outside of iOS, as only a minority of Fortnite's users play exclusively on Apple's mobile platform. According to Epic, Fortnite currently has an estimated 350 million users across all platforms.<sup>48</sup> Of these, 116 million play Fortnite on one or more platforms that include iOS (about 33 percent).<sup>49</sup> However, only about 73 million (63 percent of 116 million) of these users have only played the game on iOS. The other roughly 43 million (37 percent of 116 million) users also play Fortnite on at least one more platform, according to Epic.<sup>50</sup>

35. At most 21 percent of Fortnite users therefore exclusively play Fortnite on iOS (=  $73 \div 350$ ), consistent with Epic being willing and able to switch the distribution and monetization of Fortnite from iOS to other platforms. These numbers are not surprising. A June 2018 survey found that consumer multihoming is common, with 59 percent of gamers in the United States claiming to use more than one type of device to play video games.<sup>51</sup> Another study found that the majority of Fortnite

<sup>48</sup> Sweeney Declaration, ¶ 3 ("As of June 2020, *Fortnite* topped 350 million registered users around the world.").

<sup>49</sup> Sweeney Declaration, ¶ 3 ("More than 116 million registered users have accessed *Fortnite* on an iOS device—more than any other platform.").

<sup>50</sup> Sweeney Declaration, ¶ 3 ("From the time *Fortnite* was launched on iOS through August 13, 2020, it averaged 2.5 million daily iOS players, representing nearly 10% of *Fortnite*'s total average daily players. 63% of *Fortnite* users on iOS access *Fortnite* only on iOS.").

<sup>51</sup> NPD, "Gamer Segmentation," 2019, available at <https://s3-us-east-2.amazonaws.com/igda-website/wp-content/uploads/2019/10/16161926/NPD-2018-2019-Gamer-Segmentation-Report-White-Paper.pdf>, accessed on September 14, 2020, p. 10.

players play on video game consoles and that only 12 percent of battle royale players (the category of games that includes Fortnite) mainly play on mobile.<sup>52</sup>

36. Furthermore, the above figures may overstate the significance of iOS to Fortnite in at least two ways. First, many of the 73 million consumers who have played Fortnite only on iOS may own a second platform that they could play Fortnite on if they could not play on iOS. Second, many of the 116 million users who play on iOS may not be active users. This would be consistent with the observation that users are much less likely to be active on iOS than on other platforms. Epic estimates that Fortnite had an average of only 2.5 million daily active users on iOS, or about 10 percent of all daily active users, despite iOS players representing a third of the total user base (per Epic, 116 of 350 million).<sup>53</sup> Epic does not appear to have disclosed how many of the 2.5 million daily active users on iOS play exclusively on iOS.

37. Thus, Epic has alternatives to iOS or smartphones in distributing and monetizing users, indicating that the relevant antitrust market is broader than just iOS.

### *3.2.2. Epic's behavior is consistent with a belief that it can shift Fortnite players and revenue from iOS to other platforms*

38. Epic chose to introduce the “Direct Pay” option that precipitated this litigation shortly before the launch of the highly anticipated “Marvel Season” in Fortnite.<sup>54</sup> Epic admits to anticipating that its actions would lead to the removal of Fortnite from the App Store.<sup>55</sup> As a matter of economic logic, the fact that it chose to forgo iOS as a distribution channel indicates that it has other ways of reaching consumers. As explained above, many consumers already play Fortnite across multiple platforms, and Epic may believe that those who do not may switch platforms if the game is not available on iOS.

<sup>52</sup> Stijn Wernars, “Newzoo’s Battle Royale Sentiment Study: Understanding the Phenomena and What draws Players to Particular Franchises,” *Newzoo*, July 11, 2019, available at <https://newzoo.com/insights/articles/newzoos-battle-royale-sentiment-study-understanding-the-phenomena-and-what-draws-players-to-particular-franchises/>, accessed on September 10, 2020. The study found that 71% of Battle Royale gamers played mainly on game consoles, and 17% played mainly on PCs.

<sup>53</sup> Sweeney Declaration, ¶ 3 (“From the time *Fortnite* was launched on iOS through August 13, 2020, it averaged 2.5 million daily iOS players, representing nearly 10% of *Fortnite*’s total average daily players. 63% of *Fortnite* users on iOS access *Fortnite* only on iOS.”).

<sup>54</sup> The Fortnite Team, “Announcing Epic Direct Payment on Mobile,” *Epic Games: Fortnite*, August 12, 2020, available at <https://www.epicgames.com/fortnite/en-US/news/announcing-epic-direct-payment-on-mobile>, accessed on September 10, 2020; and Fortnite, “Fortnite Chapter 2 – Season 4,” August 27, 2020, available at <https://www.epicgames.com/fortnite/en-US/chapter-2-season-4>, accessed on September 10, 2020.

<sup>55</sup> Epic Motion for Preliminary Injunction, pp. 1:12–15 (“Not only did it remove *Fortnite* from the App Store, which Epic anticipated, but it also declared it would terminate every one of Epic’s Apple Developer Program accounts and cut off Epic’s access even to software tools that are widely available to the public.”).



39. Indeed, Epic has prominently encouraged users to switch to platforms other than iOS during the present litigation. This includes messages on its website, social media, direct marketing, and even within the game. For example:

“If you’re left behind on iOS after the Chapter 2 - Season 4 launch, the party continues on PlayStation 4, Xbox One, Nintendo Switch, PC, Mac, GeForce Now, and through both the Epic Games App at [epicgames.com](https://www.epicgames.com) and the Samsung Galaxy Store... iOS players should check this list of alternative Fortnite-compatible devices, you may already have access to another way to play Fortnite. If so, simply install the game and login with your Epic account to get up and running.”<sup>56</sup>

40. Epic’s behavior with respect to Android is consistent with mobile devices being less important to Epic as a distribution channel. As explained earlier, Epic gave Fortnite a staggered release on Android, taking a year and a half to make it available on the Google Play Store (§ 3.1.1). Moreover, just as it did here, Epic chose to modify Fortnite on Android in a way that led to its removal from the Google Play Store and to litigation with Google.<sup>57</sup>

### ***3.3. Dr. Evans’ switching costs analysis is fatally flawed and uninformative***

41. Dr. Evans argues that consumers who own iPhones face switching costs that minimize the Android ecosystem’s ability to competitively restrain Apple from “having substantial market power in the smartphone software platform market.”<sup>58</sup> His analysis is fatally flawed and uninformative on market definition, because it does not focus on the relevant switching behavior.

42. The question is not whether Epic can convince consumers to switch their smartphone from an iPhone to an Android, but whether Epic can convince consumers to play Fortnite on any platform other than iOS. The facts indicate that Epic can. As explained above, developers like Epic can and do distribute videogames like Fortnite across multiple platforms (see § 3.1). Moreover, only a minority of consumers play Fortnite exclusively on iOS, a fact that is consistent with Epic’s messaging to consumers during this litigation and its choice to violate its developer

<sup>56</sup> Fortnite Team, “JOIN THE BATTLE AND PLAY IN THE #FREEFORTNITE CUP ON AUGUST 23,” *Epic Games*, August 20, 2020, available at <https://www.epicgames.com/fortnite/en-US/news/freefortnite-cup-on-august-23-2020>, accessed on September 10, 2020.

<sup>57</sup> Dieter Bohn, “Fortnite for Android has also been kicked off the Google Play Store,” *The Verge*, August 13, 2020, available at <https://www.theverge.com/2020/8/13/21368079/fortnite-epic-android-banned-google-play-app-store-rule-violation>, accessed on September 14, 2020.

<sup>58</sup> Evans Declaration, ¶¶ 43–46.

contract with Apple weeks before it launched Fortnite's new Marvel Season (see § 3.2).

43. Note that most consumers' ability to play Fortnite on platforms other than iOS, purchase V-Bucks on other platforms, and transfer V-Bucks between platforms indicate that iOS app distribution is not a relevant aftermarket, as Epic claims. Dr. Evans, notably, does not define app distribution as an aftermarket.<sup>59</sup> It also appears that the elements present in establishing aftermarket power are not present here.<sup>60</sup> For example, consumers are not "locked in" and Apple's commission and app distribution policies are well known and have not changed (see § 4.3).

44. Even if some consumers did not have the option to play Fortnite on a platform other than iOS, it does not necessarily follow as a matter of economic logic that the market is no broader than iOS. The number of marginal users that do switch to alternatives could well be sufficient to defeat a price increase or quality decrease, implying that the relevant antitrust market is broader. Indeed, Epic's behavior in this case is consistent with an expectation that many consumers will switch (see § 3.2.2).

45. Dr. Evans also exaggerates the difficulty of switching from iOS to Android devices in at least two ways. First, consumers do switch. Second, consumers that do not switch are not necessarily locked in.

- While smartphones are durable goods and can last several years, almost half of consumers replace their smartphones every 2 years, with carriers encouraging this replacement through various programs and strategies.<sup>61</sup> Apple must compete with other smartphone devices each time that a

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<sup>59</sup> Epic Motion for Preliminary Injunction, p. 20:12–13 ("First, app distribution on iOS is an 'aftermarket' that is 'wholly derivative from and dependent on the primary market,' *id.* At 1049, which is smartphone (or tablet) OSs.").

<sup>60</sup> Carl Shapiro, "Aftermarkets and Consumer Welfare: Making Sense of Kodak," *Antitrust Law Journal* 63, no. 2, 1995, pp. 483–512 at 486–487 ("There are three key elements to an aftermarket...and (3) there is some degree of 'lock-in' or sunk costs, i.e., at least some of the expenditures on the initial component(s) cannot be recovered if the consumer later switches brands. ... Economics currently offers four theories of aftermarket power: (1) The 'Surprise' Theory... (2) The 'Costly Information' Theory... (3) The 'Limited Manufacturer Commitment' Theory... (4) The 'Price Discrimination' Theory.").

<sup>61</sup> 44% of U.S. adult smartphone users switch phones as soon as their cellphone provider allows it, usually every two years. 51% of iPhone users switch as soon as cellphone providers allow it. See Art Swift, "Americans Split on How Often They Upgrade Their Smartphones," *Gallup*, July 8, 2015, available at [https://news.gallup.com/poll/184043/americans-split-often-upgrade-smartphones.aspx?utm\\_source=Economy&utm\\_medium=newsfeed&utm\\_campaign=tiles](https://news.gallup.com/poll/184043/americans-split-often-upgrade-smartphones.aspx?utm_source=Economy&utm_medium=newsfeed&utm_campaign=tiles), accessed on September 9, 2020.

consumer replaces their phone, and studies indicate that Apple loses a significant fraction of customers to Android every year.<sup>62</sup>

- Dr. Evans is also wrong to interpret repeat business as evidence of switching costs. The economics and marketing literature recognizes that consumers may buy the same product repeatedly over time not because it is too costly to switch to another product, but because they prefer the product that they keep buying.<sup>63</sup> Several of the “switching costs” that Dr. Evans identifies are properly understood as real value that Apple has added to the iOS ecosystem in its efforts to compete, not as switching costs that are locking consumers in.<sup>64</sup> For example, iCloud Photos, iCloud Drive, Apple News, and Apple TV+ do not constitute switching costs. These services exist in the first place precisely because Apple continuously innovates and rolls out new features and service to make its platform more attractive than the platforms of its competitors.

46. Dr. Evans’ switching cost discussion is therefore fatally flawed and insufficient as support for his inappropriately narrow market definition.

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<sup>62</sup> Public estimates regarding the share of iOS users that switch to Android range roughly from 10% to 30%. See BankMyCell, “iPhone Trade-in Vs. Brand Retention,” available at <https://www.bankmycell.com/blog/iphone-trade-in-loyalty-study/>, accessed on September 7, 2020; Eric Griffith, “Why Do People Switch Between Mobile Operating Systems?,” *PC*, August 23, 2018, available at <https://www.pcmag.com/news/why-do-people-switch-between-mobile-operating-systems>, accessed on September 14, 2020; Consumer Intelligence Research Partners, LLC, “Mobile Operating System Loyalty: High and Steady,” March 8, 2018, available at <http://files.constantcontact.com/150f9af2201/4bca9a19-a8bo-46bd-95bd-8574off3fb5d.pdf>, accessed on September 14, 2020; and sellcell, “iPhone vs Android – Cell Phone Brand Loyalty Survey 2019,” August 20, 2019, available at <https://www.sellcell.com/blog/iphone-vs-android-cell-phone-brand-loyalty-survey-2019/> accessed on September 14, 2020.

<sup>63</sup> Pei-Yu Chen and Lorin M. Hitt, “Information technology and switching costs,” *Handbook on Economics and Information Systems* 1, 2006, pp. 437–470 at 443 (“This simple framework illustrates why it can be difficult to separate out the effects of product quality (increasing utility) or creating lock-in (increasing switching costs) in empirical data since they can behave in similar ways. Improving the quality of your product increases the utility of your product relative to others. Raising switching costs lowers the utility of other products for your existing customers. Thus, a firm can be successful at retaining customers either because they offer a superior product (at least for a specific set of consumers), or because they have high switching costs.”).

<sup>64</sup> Evans Declaration, ¶ 46 (“I identify eight sources of switching costs that, while they do not preclude people from changing smartphone software platforms, make it less likely they will do so in the face of an exercise of market power which causes a substantial increase in the cost, or decrease in the quality, of using the iOS software platform overall.”). Dr. Evans argues that consumers who use Apple services such as iCloud Photos, iCloud Drive, Apple News, Apple TV+, FaceTime, Find My, and AirDrop would “effectively” [emphasis added] lose access to those services if they switched to an Android smartphone. See Evans Declaration, ¶ 46 (“Other apps, such as FaceTime...Find My..., and AirDrop...allow users to connect with their friends and family, but can’t be used on Android smartphones. iPhone users who are connected to Apple services, such as iCloud Photos, iCloud Drive, Apple News, and Apple TV+, would effectively lose access to those services if they switched to an Android smartphone.”). But Apple’s incentives to make its platform more competitive are precisely what drove Apple to develop these apps and to include them with its products. That these apps may be valued by consumers and that they may be part of what drives their mobile platform choices is evidence of competition, not lock-in.

#### **4. Apple does not possess monopoly power**

47. Epic alleges that Apple is a monopolist of iOS distribution services, with a 100 percent share of Epic's alleged market.<sup>65</sup> This allegation critically relies on Epic's improper market definition. As I explained in the prior section, the relevant antitrust market for videogame distribution is substantially broader, including at least the several other platforms on which Epic distributes and monetizes Fortnite.

48. In the rest of this section I explain that allegations that Apple possesses monopoly power are also refuted directly by (a) evidence on the competitive constraints that Apple faces from other platforms, (b) evidence on Epic's ability to monetize Fortnite without paying Apple's commission, and (c) evidence that Apple's commission is not supracompetitive.

##### ***4.1. Apple has a low share of a properly defined relevant antitrust market***

49. As noted earlier, the relevant antitrust market is at least broad enough to include personal computers (PC and Mac), handhelds (e.g., the Nintendo Switch), consoles (e.g., PS4 or Xbox One), other handheld device platforms (e.g., Android smartphones and tablets, and Microsoft Surface tablets), streaming game platforms (e.g., GeForce Now), and may also include various web gaming platforms that either operate independently or alongside other platforms (e.g., Facebook games). Apple holds far less than a 100 percent share within such a market.

50. Measuring the appropriate share of each platform for videogames, and Fortnite in particular, involves a number of considerations. Shares can be calculated based on revenue, number of registered users, number of registered users within a time period, and more. I consider several different approaches, and find that Apple's share of the market in which Epic distributes Fortnite is consistently small, roughly in the 10 to 20 percent range.

- The share of Fortnite registered users that are iOS-only is 21 percent.<sup>66</sup>

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<sup>65</sup> Epic Motion for Preliminary Injunction, p. 14:27–28 (“Apple’s market share in iOS app distribution is 100%, as the App Store is the *only* approved means by which developers may distribute apps.”).

<sup>66</sup> Out of Fortnite’s more than 350 million registered users, 116 million registered users have accessed Fortnite on an iOS device. However, 37% of those have also accessed Fortnite on other platforms. The share of iOS-only Fortnite registered users is 21% ( $= (116 \times 0.63) \div 350$ ). See Sweeney Declaration, ¶ 3 (“As of June 2020, Fortnite topped 350 million registered users around the world... More than 116 million registered users have accessed Fortnite on an iOS device... 63% of Fortnite users on iOS access Fortnite only on iOS.”).

- Epic claims that iOS players represent “nearly 10 percent” of Fortnite’s total average daily players (a potentially more informative measure of share) through August 13, 2020.<sup>67</sup> Daily Active Users is a well-established and common metric in discussing engagement with online videogames.<sup>68</sup>
- During 2018 and 2019 iOS accounted for only 10–14 percent of Epic’s estimated \$4.2 billion of revenue from Fortnite.<sup>69</sup> Economists frequently measure market shares using revenues.<sup>70</sup>

51. Epic understands Apple’s low share of the relevant antitrust market and leveraged this fact in negotiations with Apple to obtain greater levels of support and other non-price concessions.<sup>71</sup> For example, Epic repeatedly referred to Apple as the “smallest piece of the pie” in terms of Fortnite revenue and threatened to remove the game from iOS.<sup>72</sup>

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<sup>67</sup> Sweeney Declaration, ¶ 3 (“From the time Fortnite launched on iOS through August 13, 2020, it averaged 2.5 million daily iOS players, representing nearly 10% of Fortnite’s total average daily players.”)

<sup>68</sup> Paayal Zaveri, “Microsoft Teams now has 75 million daily active users, adding 31 million in just over a month,” Business Insider, April 29, 2020, available at <https://www.businessinsider.com/microsoft-teams-hits-75-million-daily-active-users-2020-4>, accessed on September 12, 2020 (“Microsoft Teams now has 75 million daily active users, CEO Satya Nadella said on the company’s earnings call with analysts on Wednesday”); and Megan Farokhmanesh, “League of Legends has 27 million daily active players,” Polygon, January 27, 2014, available at <https://www.polygon.com/2014/1/27/5350944/league-of-legends-has-27-million-daily-active-players>, accessed on September 12, 2020.

<sup>69</sup> According to internal Apple data, Fortnite billed \$335.9 million through the App Store in 2018 and \$254.6 million in 2019, for a total of \$590.5 million across these two years. After the 30% commission, this amounts to \$413.4 million in revenue. Epic earned an estimated total of \$4.2 billion from Fortnite across 2018 and 2019. See Andrew Webster, “Fortnite made an estimated \$2.4 billion last year,” *The Verge*, January 16, 2019, available at <https://www.theverge.com/2019/1/16/18184302/fortnite-revenue-battle-pass-earnings-2018>, accessed on September 10, 2020; and Bijan Stephen, “Fortnite’s overall revenue slipped in 2019, but it was still the biggest earner of the year,” *The Verge*, January 2, 2020, available at <https://www.theverge.com/2020/1/2/21046920/fortnite-revenue-drop-superdata-nielsen-2019-earnings>, accessed on September 10, 2020. It is not clear from public sources whether the \$4.2 billion figure corresponds to gross revenues (before any platform commissions) or whether it represents Epic’s net revenue from Fortnite. If it is the former, iOS was only 14.0% of Epic’s Fortnite revenue ( $= 590.5 \div 4,200$ ). If it was the latter, iOS was only 9.8% of Epic’s Fortnite revenue ( $= 413.4 \div 4,200$ ).

<sup>70</sup> Horizontal Merger Guidelines, § 5.2 (“In most contexts, the Agencies measure each firm’s market share based on its actual or projected revenues in the relevant market. Revenues in the relevant market tend to be the best measure of attractiveness to customers, since they reflect the real-world ability of firms to surmount all of the obstacles necessary to offer products on terms and conditions that are attractive to customers.”).

<sup>71</sup> Schmid Declaration, ¶ 8 (“Apple similarly expedited propagation of Fortnite updates across App Store storefronts on several occasions when Epic proclaimed that its particular launch timing was critical in order to ensure seamless and simultaneous cross-play across different platforms, like iOS and those related to game-console devices like Xbox and PlayStation. Epic consistently threatened to release the game update on other platforms first, leaving App Store users behind, if Apple could not accommodate their requests.”).

<sup>72</sup> Schmid Declaration, ¶ 18 (“On a variety of occasions, Epic personnel have told me that if Apple did not comply with its demands, Epic would simply terminate its relationship with Apple and remove its games off of the iOS platform. Epic has repeatedly told me that it could do this because Apple is the “smallest piece of the pie” when it came to *Fortnite* revenue. On several occasions, Epic personnel have told me that Apple represents just seven percent of Epic’s revenue.”).

#### **4.2. Epic has alternative monetization options both within and outside iOS**

52. As discussed by Professor Schmalensee, the App Store offers a wide range of monetization options to Epic and other developers.<sup>73</sup> Beyond the option to earn revenue from in-app advertising, which Dr. Evans highlighted,<sup>74</sup> developers are also able to (a) sell content outside of the app (which Fortnite does, including allowing the content and “V-bucks” sold outside of the App Store to be used on the iOS version of the game),<sup>75</sup> (b) provide subscriptions both within and outside of iOS, (c) earn revenue from other sources, such as physical goods or promotional partnerships, and (d) sell content directly from websites, including offering alternative packages and further discounts that are not available on iOS. These options constrain Apple’s ability to exercise market power.

53. For example, one of Fortnite’s competitors does the latter. Roblox, a popular multiplatform videogame that allows players to create their own games within it, sells its “Robux” through in-app purchases on the iOS platform at an exchange rate of 80 “Robux” per dollar. Consumers can instead purchase larger “Robux” packages at up to a 20 percent discount to the iOS exchange rate if they buy directly from the website instead of from within the iOS app.<sup>76</sup> This option is available to all Roblox players. Even someone who does not have access to non-iOS devices can make this purchase without any commission from Apple through the iOS web browser.<sup>77</sup>

54. Epic has found other ways to directly or indirectly monetize Fortnite. For example, Epic has used Fortnite to host music concerts,<sup>78</sup> to screen exclusive trailers

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<sup>73</sup> Schmalensee Declaration, ¶¶ 26–28 (“When offering their apps to users in the App Store, developers can choose between the *Free Model*, *Freemium Model*, *Paid Model*, *Paymium Model*, and the *Subscription Model*... Developers can also choose a *Subscription Model*, in which users are charged a subscription fee on an ongoing basis.”).

<sup>74</sup> Evans Declaration, footnote 106 (“While digital content developers could theoretically avoid paying the App Store by offering their apps for free and then selling things in-app, they can do the same thing under Apple’s rules right now by offering their apps for free and earning revenue from in-app advertising.”).

<sup>75</sup> Epic Games, “FAQ,” August 17, 2020, available at <https://www.epicgames.com/fortnite/en-US/faq>, accessed on September 7, 2020 (“V-Bucks purchased on Nintendo Switch and PlayStation 4 can only be spent on the platform they were purchased on. All other V-Bucks purchases are available across platforms, and all purchased items can be accessed across platforms you play Fortnite on.”).

<sup>76</sup> Consumers can purchase 1,700 “Robux” for only \$19.99 if they buy directly from the Roblox website, representing a 5 percent discount to the iOS exchange rate. Consumers shopping on the Roblox website can also buy 10,000 “Robux” at a 20 percent discount relative to the iOS in-app purchase exchange rate.

<sup>77</sup> See Roblox, “Buy Robux,” available at <https://www.roblox.com/upgrades/robux>, accessed on September 9, 2020.

<sup>78</sup> Andrew Webster, “Fortnite is launching a concert series it hopes will become a ‘tour stop’ for artists,” *The Verge*, September 8, 2020, available at <https://www.theverge.com/2020/9/8/21423004/fortnite-party-royale-concert-series-dominic-fike>, accessed on September 8, 2020.



for high profile upcoming films,<sup>79</sup> to advertise Nike's Air Jordan brand,<sup>80</sup> to promote the release of high profile films like Marvel's *Avengers: Endgame*,<sup>81</sup> and to announce the design of new computer hardware.<sup>82</sup> Under Apple's App Store business model, Apple does not share in any of the revenue that Epic may directly generate from these agreements. As one publication noted:

"I've never played a game that was trying to sell me something nearly as often as *Fortnite* does, whether that's an in-game item, mode, or a reminder of a real-world product. ... In 2019, *Fortnite* isn't just a battle royale game with building mechanics: It's also one of the most popular and effective ways to promote a product."<sup>83</sup>

55. While these activities were not exclusive to iOS, Apple assisted Epic in some of them, such as using connections at Apple Music to facilitate concerts or by paying to advertise a Fortnite concert on a Times Square billboard.<sup>84</sup>

#### ***4.3. Apple's commission is not supracompetitive and does not support Epic's claim that Apple possesses monopoly power***

56. Beyond alleging that Apple is a monopolist of iOS distribution services,<sup>85</sup> Epic also alleges that Apple's commission (which Epic inappropriately diminishes to

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<sup>79</sup> Angela Watercutter, "Fortnite Debuted a Scene From Star Wars: The Rise of Skywalker," *Wired*, December 16, 2019, available at <https://www.wired.com/story/fortnite-star-wars/>; accessed on September 8, 2020; and Richard Lawler, "Fortnite Party Royale premiered Christopher Nolan's new 'Tenet' trailer (updated)," *Engadget*, May 21, 2020, available at <https://www.engadget.com/tenet-fortnite-trailer-203929743.html>, accessed on September 8, 2020.

<sup>80</sup> Austen Goslin, "Air Jordans come to Fortnite in Nike partnership," *Polygon*, May 22, 2019, available at <https://www.polygon.com/fortnite/2019/5/22/18634329/fortnite-jumpman-air-jordan-skins-hang-time-nike>, accessed on September 14, 2020.

<sup>81</sup> Austen Goslin and Russ Frushtick, "Fortnite's new Avengers: Endgame mode is live," *Polygon*, April 25, 2019, available at <https://www.polygon.com/fortnite/2019/4/25/18513061/fortnite-avengers-crossover-game-mode-endgame-mode-patch-notes-850>, accessed on September 14, 2020.

<sup>82</sup> Sean Hollister, "AMD reveals its Radeon RX 6000 GPU design on Twitter — and in Fortnite," available at <https://www.theverge.com/circuitbreaker/2020/9/14/21436996/amd-radeon-rx-6000-gpu-design-teaser-fortnite>, accessed on September 15, 2020 ("Remarkably, AMD is letting you check out a full render of the card in its own Fortnite island, though we don't expect many surprises that you can't already see in the full, high-res image below.").

<sup>83</sup> Patricia Hernandez, "Fortnite is basically a giant, endless advertisement now," *Polygon*, May 23, 2019, available at <https://www.polygon.com/2019/5/23/18635920/fortnite-jumpman-john-wick-marvel-brand-advertisement>, accessed on September 14, 2020.

<sup>84</sup> See Schmid Declaration, ¶ 11 ("To promote concerts taking place in *Fortnite*, Apple has featured the app on the App Store and in Apple Music, and placed a billboard in New York's Times Square to promote an in-app *Fortnite* concert with DJ Marshmello."); and Apple Counterclaim Reply, p. 1:22–25 ("And each time Epic released a new season of *Fortnite*, Apple put it in the spotlight, providing free promotion and favorable tweets, ultimately sending over 500 million marketing communications to end users, and even paying for a billboard in Times Square to promote a particular *Fortnite* in-app concert.").

<sup>85</sup> Epic Motion for Preliminary Injunction, p. 14:27–28 ("Apple's market share in iOS app distribution is 100%, as App Store is the only approved means by which developers may distribute consumer apps.").

merely a fee for in-app payment processing) is supracompetitive.<sup>86</sup> Epic's allegation that Apple can charge monopolistic prices is refuted by strong evidence that Apple's commission is not supracompetitive. Note that, unlike Epic, Dr. Evans does not appear to claim that Apple has raised prices, lowered quality, engaged in anticompetitive behavior, or otherwise harmed consumers.

57. Apple has never raised the 30 percent base commission it charges from developers.<sup>87</sup> It has only reduced it while introducing flexibility for developers over time. For example, Apple introduced subscriptions in 2011,<sup>88</sup> and since September 2016 charges only 15 percent for subscriptions after their first year.<sup>89</sup> When the App Store was launched in July 2008, Apple had sold 6 million iPhone units and was still attempting to establish itself in the cellphone market by developing an intuitive and all-encompassing platform for mobile devices.<sup>90</sup> That Apple charged developers a 30 percent commission in 2008, when it had a relatively small number of devices and a small number of apps shows that the 30 percent commission is likely set by platform development concerns, and is not a result of monopoly power.<sup>91</sup> By November 2018, Apple had sold 2.2 billion iPhones.<sup>92</sup> That Apple has never increased its commission demonstrates that the 30 percent commission rate provides no evidence that Apple has monopoly power.

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<sup>86</sup> Complaint, ¶ 125 ("Apple charges a 30% fee for In-App Purchase. This rate reflects Apple's market power and the lack of competition, which allow Apple to charge supra-competitive prices for payment processing within the market."); and Epic Motion for Preliminary Injunction, p. 18:2-4 ("Apple wields its market power in the iOS App Distribution Market to coerce developers into using IAP.").

<sup>87</sup> Apple Counterclaim Reply, pp. 3:26-4:3 ("And the business practices that...have existed since it debuted in 2008... All the while, Apple's commission only decreased while software prices plummeted and barriers to entry evaporated."). Apple's commission has been lowered for certain types of transactions (subscriptions, which now have a 15% commission after one year). See App Store, "Auto-renewable Subscriptions," *Apple Developer*, available at <https://developer.apple.com/app-store/subscriptions/>, accessed on September 10, 2020.

<sup>88</sup> Schiller Declaration, ¶ 32 ("In 2011, Apple developed a state-of-the-art technology so that IAP could support the purchase of subscriptions, including for magazines, music streaming and online video content, an innovative offering that developers and users alike have embraced since it was introduced.").

<sup>89</sup> Nick Statt, "Google matches Apple by reducing Play Store fee for Android app subscriptions," *The Verge*, October 19, 2017, available at <https://www.theverge.com/2017/10/19/16502152/google-play-store-android-apple-app-store-subscription-revenue-cut>, accessed on September 12, 2020 ("Back in June 2016, Apple introduced a new policy for its App Store to encourage developers to sell subscriptions as in-app purchases within iOS. That involved reducing the standard App Store transaction fee from 30 percent to 15 percent. It took effect in September of last year.").

<sup>90</sup> Tom Krazit, "Apple unveils iPhone 2, both the phone and the business," *c|net*, June 10, 2008, available at <https://www.cnet.com/news/apple-unveils-iphone-2-both-the-phone-and-the-business/>, accessed on September 8, 2020 ("Apple has sold 6 million iPhones since June 2007, Jobs said...").

<sup>91</sup> The App Store launched with only 552 apps. Lex Friedman, "The App Store turns five: A look back and forward," *Macworld*, July 8, 2013, available at <https://www.macworld.com/article/2043841/the-app-store-turns-five-a-look-back-and-forward.html>, accessed on September 12, 2020.

<sup>92</sup> Sam Costello, "How Many iPhones Have Been Sold Worldwide?" *Lifewire*, December 27, 2019, available at <https://www.lifewire.com/how-many-iphones-have-been-sold-1999500>, accessed on September 14, 2020.



58. Apple's commission structure and its base 30 percent rate is not unique. Many other app stores have a similar payment structure and the same base level of commissions. This includes mobile app stores operated by Google, Microsoft, Samsung, and Amazon; video-game specific stores run supporting the Xbox, PlayStation, and Nintendo ecosystems;<sup>93</sup> and Steam, the largest PC game distribution platform.<sup>94</sup> This is despite the fact that many of these platforms do not provide as many services as Apple does. For example, the Google Play Store does not provide the same comprehensive human-assisted app review process that the App Store does.<sup>95</sup> Apple has also competed through lowering prices, as when it lowered commissions for subscriptions. Google subsequently did the same.<sup>96</sup> As discussed by Professor Schmalensee, there is considerable evidence to suggest that Apple's commission is consistent with market prices and may be lower on a quality-adjusted basis.<sup>97</sup>

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<sup>93</sup> In a footnote, Epic attempts to distinguish Apple's commission from those charged by stores in videogame consoles by arguing that the App Store includes more than just videogames and that videogame consoles are typically sold at a loss. See Epic Motion for Preliminary Injunction, p. 22, footnote 7 ("Apple has argued that 'many video game digital marketplaces' 'have similar fees and requirements to use the marketplace's official in-app purchase functionality'. (TRO Opp'n 5.) But iOS is not a 'video game digital marketplace'. ... And unlike the gaming consoles to which Apple points, which are typically sold at a loss in a competitive market (Byars Decl., Ex. GG), iOS is an inescapable member of an upstream duopoly with extraordinary power over developers and users alike"). This argument is wrong on multiple counts. First, it is economically unjustified to argue that Apple should consider eliminating commissions because it generates significant revenues in the sale of devices. Eliminating such revenues would reduce Apple's incentives to invest in App Store services or require a price increase in devices, harming consumers and developers (see § 5.2, below). Second, the Steam videogame on platform on PC and Mac also charges a commission of 20–30%, even though the owner of Steam does not sell a console, at a loss or otherwise, to facilitate transactions between PC players and game developers. See Nick Statt, "Valve's new Steam revenue agreement gives more money to game developers," available at <https://www.theverge.com/2018/11/30/18120577/valve-steam-game-marketplace-revenue-split-new-rules-competition>, accessed on September 15, 2020 ("Normally, Valve takes around 30 percent of all game sales on Steam, with some exceptions for games from smaller developers in its Steam Direct program. That will remain the case for the first \$10 million in sales a game maker or publisher earns. For all sales between \$10 million and \$50 million, the split goes to 25 percent. And for every sale after the initial \$50 million, Steam will take just a 20 percent cut."). Third, if the distinction between app stores on videogame consoles and the App Store were that consoles focus primarily on games while the App Store offers a wide variety of apps, then Epic has the economic logic backwards. A platform owner that has to support a broader set of applications is likely to experience higher rather than lower costs in supporting their platforms. For example, Apple supports a wide variety of developers with differing technical and business requirements, while console gaming platforms can focus on a smaller number of developers focused specifically on games. The App Store is therefore likely more expensive to maintain and support, justifying a higher rather than lower commission. Yet Apple's commission is no higher than those of videogame platforms.

<sup>94</sup> Jonathan Borck et al., "Apple's App Store and Other Digital Marketplaces," *Analysis Group*, July 22, 2020, pp. 5, 7; PCGames, "With \$4.3 billion in sales, 2017 was Steam's biggest year yet," available at <https://www.pcgamesn.com/steam-revenue-2017>, accessed on September 12, 2020.

<sup>95</sup> For example, see BuildFire, "iOS vs Android: Which Should You Build Your Mobile App on First," available at <https://buildfire.com/ios-android-which-to-develop-on-first/>, accessed on September 14, 2020.

<sup>96</sup> Nick Statt, "Google matches Apple by reducing Play Store fee for Android app subscriptions," *The Verge*, October 19, 2017, available at <https://www.theverge.com/2017/10/19/16502152/google-play-store-android-apple-app-store-subscription-revenue-cut>, accessed on September 10, 2020.

<sup>97</sup> Schmalensee Declaration, ¶ 62 ("Besides being economically sensible, as noted above, this strategy is also in line with industry practice. Apple's App Store monetization strategy closely resembles the monetization strategies of other digital marketplaces, and the App Store's rates are in line with those of other comparable marketplaces. App stores

59. Moreover, since the commission has stayed constant but the breadth of features available to developers in 2020 is far greater than in 2008, quality-adjusted prices have dramatically fallen. The amount of services and support offered by Apple to developers has only increased over time. Apple has also made available to developers the many phone features that customers enjoy. Apple's history of continuing to innovate on consumer and developer-facing features such as more memory, faster processors, better cameras, brighter and higher resolution screens, integrated devices (GPS, 3-D gyroscope, heart rate monitor) and expanded input options, among others, is consistent with the idea that they have incentive to improve their products because of the positive externality between creating the phone and running the App Store. The improvements in the GPU and the underlying graphics APIs have been particularly important in enabling graphics-intensive video games such as Fortnite.<sup>98</sup> These features have opened up the opportunities for new types of applications or expanded the value of existing applications without any commission increases or expansion to include other types of revenue streams.<sup>99</sup>

60. Finally, the mix of monetization types over the years is also relevant. In 2008, the App Store consisted only of free-to-download apps and pay-to-download apps. There were no in-app purchases and no subscriptions.<sup>100</sup> In 2020, the amount of

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such as Google Play Store, Amazon Appstore, Samsung Galaxy Store, and Microsoft Store also charge commission rates of 30 percent...").

<sup>98</sup> The "Metal" API was first released in 2014, and Epic stated that it was "very excited about the new levels of graphical quality and efficiency made possible by Metal." See Josh Adams, "UE4 'Zen Garden' Using Metal API for iOS 8 Revealed at WWDC," *Unreal Engine*, June 2, 2014, available at <https://www.unrealengine.com/en-US/blog/ue4-zen-garden-using-metal-api-for-ios-8-revealed-at-wwdc>, accessed on September 10, 2020. CPU and GPU benchmarks for Apple devices have been increasing over time. See Killian Bell, "Tests confirm iPhone 11 Pro is king in CPU and GPU performance," *Cult of Mac*, October 17, 2019, available at <https://www.cultofmac.com/659484/iphone-11-pro-king-cpu-gpu-performance/>, accessed on September 10, 2020 ("Overall, A13 is the best mobile chip on the market today. It makes the iPhone 11 series far faster than any of its rivals, as well as previous Apple handsets."); and ScientiaMobile, "Fortnite and Smartphone GPU," August 7, 2019, available at <https://www.scientiamobile.com/fortnite-and-smartphone-gpu/>, accessed on September 10, 2020 ("[Graphical Processor Units (GPU)] improve the performance in the rendering of videos, games, and other graphics...In 2015, Apple started to manufacture its own GPU for most of its smartphones, now being the second most popular with 25.75%...Fortnite recommends a minimum level of OS version, RAM, and GPU...84.27% of iPhone usage today comes from devices that meet Fortnite's requirements. In contrast, only 19.34% of Android devices in use today meet Fortnite requirements").

<sup>99</sup> For example, see Discover, "Meet the developer: Philip Lam," *Apple Developer*, April 24, 2020, available at <https://developer.apple.com/news/?id=wk9cj822>, accessed on September 9, 2020 ("[HomeCourt] uses artificial intelligence (A.I.) and augmented reality (AR) to create and shape on-court basketball drills. It can tell whether you're shooting off the dribble, catching and shooting, or just practicing free throws...We built HomeCourt on mobile to make it affordable to players around the world.... The new iPhone series came in September 2018, and it was a much more powerful device for running machine-learning algorithms. We found our algorithm [ran] six times faster in the iPhone series with the A12 Bionic chip. With the optimization in our algorithm, we could finally offer Real-Time Shot Science. The opportunity to demonstrate that at the 2018 Apple iPhone event [was] definitely one of the most special days in our journey so far.").

<sup>100</sup> Schiller Declaration, ¶ 32 ("When the App Store launched in 2008, iOS users could not make in-app purchases...So in 2009, Apple introduced an in-app purchase functionality to the App Store, which is known as 'IAP'.... In 2011, Apple developed a state-of-the-art technology so that IAP could support the purchase of subscriptions, including for

free-to-download apps has far outgrown the amount of paid-to-download apps and subscriptions have been introduced.<sup>101</sup> Effectively, the number of available options to developers has increased (a quality improvement) and the share of the total output (measured as the sum of both in-app purchases and other monetization) that Apple actually collects on has very likely gone down, not up (a price reduction). Put together, the body of evidence on the evolution of the App Store over time is inconsistent with Apple's commission being supracompetitive.

## **5. Apple's procompetitive business strategy generates substantial surplus for developers and consumers, which Epic's proposals would put at risk**

61. Dr. Evans does not appear to claim that Apple has raised prices, lowered quality, engaged in anticompetitive behavior, or otherwise harmed consumers. To the contrary, there is abundant evidence that Apple's App Store business strategy has led to large procompetitive benefits. The alternative monetization schemes that Epic proposed in this litigation would disrupt this business model and put its benefits at risk.

### ***5.1. The App Store business model generates multiple benefits for developers and consumers***

62. The App Store has been tremendously successful as a platform under Apple's existing business strategy. Market research indicates that the App Store ecosystem has generated as much as \$61 billion from the billings and sales of digital goods and services, most of which has gone to developers. It has also generated \$413 billion from sales of physical goods and services through apps, and \$45 billion from in-app advertising worldwide in 2019, sources of developer income on which Apple does not collect commissions.<sup>102</sup>

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magazines, music streaming and online video content, an innovative offering that developers and users alike have embraced since it was introduced.”).

<sup>101</sup> Apple Counterclaim Reply, p. 8:10–11 (“...Apple receives no revenue from 84% of apps distributed through the App Store, and billions of apps are downloaded every day without Apple receiving a penny.”). In 2008, the App Store launched with only 522 apps, 135 of which were free. Lex Friedman, “The App Store turns five: A look back and forward,” *Macworld*, July 8, 2013, available at <https://www.macworld.com/article/2043841/the-app-store-turns-five-a-look-back-and-forward.html>, accessed on September 12, 2020. Additionally, the commission rate on also decreases to 15% after one year. See App Store, “Auto-renewable Subscriptions,” *Apple Developer*, available at <https://developer.apple.com/app-store/subscriptions/>, accessed on September 10, 2020.

<sup>102</sup> Jonathan Borck et al., “How Large is the Apple App Store Ecosystem?” *Analysis Group*, August 2020, p. 2. (“We estimate that the Apple App Store ecosystem facilitated more than \$500 billion in billings and sales worldwide in 2019...consists of \$61 billion from billings and sales of digital goods and services (12% of the total), \$413 billion from

63. The fact that total output generated by the Apple platform is increasing and that quality adjusted prices (that is, the commission rate taking into account improvements in the underlying services) are declining are strong indicators of healthy competition. The total output of transactions in the App Store has consistently increased. Analysts indicate that, as of early 2018, spending on the App Store had been “rising steadily, adding about \$5 billion/yr since mid 2011.”<sup>103</sup> The strong growth of the platform measured by total revenue is evidence of competition and innovation, not of a completely monopolized market, where an economist would expect the monopolist to suppress total output in order to maximize profits.

64. Beyond increasing topline revenue, it is also well established in the literature, in the public press, and recognized by Dr. Evans that the iOS platform is more valuable on a per-user basis. For example, while Android has more app downloads from the Google Play Store than iOS does from the App Store, one study found that iOS users collectively spent about 1.9 times as much on mobile apps as Android users in the Google Play Store in the first half of 2018.<sup>104</sup> Dr. Evans acknowledges that “the average iPhone has more capabilities relevant for consuming apps than the average Android phone and therefore likely appeals to people who tend to use apps more.”<sup>105</sup>

65. The additional value that iOS generates does not exist in a vacuum. Apple attracts high-value consumers directly by continually adding new and better consumer-facing features to its devices and its App Store platform. It also attracts them indirectly, by adding developer-facing features to its platform, which attract

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sales of physical goods and services through apps (80% of the total), and \$45 billion from in-app advertising (9% of the total).”).

<sup>103</sup> Horace Dediu, “The iOS Economy, Updated,” *Asymco*, January 8, 2018, available at <http://www.asymco.com/2018/01/08/the-ios-economy-updated/>, accessed on September 10, 2020 (“The spending on App Store has been rising steadily, adding about \$5 billion/yr since mid 2011”).

<sup>104</sup> According to data from SensorTower, iOS users spent \$22.6 billion while Android users spent \$11.8 billion in the Google Play Store in the first half of 2018. In contrast, the number of downloads made through Google Play (76 billion) is 2.5 times larger than that through the Apple App Store (30 billion) in 2018. See Sarah Perez, “App revenue tops \$39 billion in the first half of 2019, up 15% from first half of last year,” *Tech Crunch*, July 3, 2019, available at <https://techcrunch.com/2019/07/03/app-revenue-tops-39-billion-in-first-half-of-2019-up-15-from-first-half-of-last-year/>, accessed on September 10, 2020; and Mansoor Iqbal, “App Download and Usage Statistics (2019),” *Business of App*, September 7, 2020, available at <https://www.businessofapps.com/data/app-statistics/>, accessed on September 10, 2020. Academic literature also finds that Google Play users are more price sensitive than Apple users. See, for example, Anindya Ghose and Sang Pil Han, “Estimating demand for mobile applications in the new economy,” *Management Science* 60(6), 2014, pp. 1470–1488 at 1482 (“We find that the app demand is more price elastic in Google Play than in Apple App Store...Our counterfactual experiments...also demonstrate, that Google Play users are more price sensitive than Apple users. This finding is consistent with numerous trade press reports that Apple device users are less price sensitive than device users on other platforms such as Android and Windows.”) The value of the iOS platform is also highlighted in the Evans Declaration. See Evans Declaration, ¶¶ 34–37 (“Apple has chosen to specialize in high-end smartphones compared to the average Android smartphone seller... Users with high-end smartphones are of much greater importance to app developers...iPhone users are valuable to app developers to the extent developers can make money directly or indirectly from them...”).

<sup>105</sup> Evans Declaration, ¶ 34.

more and better developers, which in turn attract more and higher value consumers. This indirect feedback loop is due to the platform nature of the App Store and means that many benefits to developers and benefits to consumers are interlinked. For example, consumers benefit from being able to download apps for free, allowing them to experiment with apps they may not have paid for to try, a consumer benefit. This in turn opens up new business models to developers, a developer benefit. See also Professor Schmalensee's discussion of indirect network effects.<sup>106</sup>

66. When evaluating platforms, it is important to recognize these complementarities that arise when a platform owner consistently and reliably invests in a wide range of services and features, as Apple does.<sup>107</sup> For instance, Apple's ability to incur the substantial investments needed to develop custom microprocessors, graphics processors, and related APIs is closely tied to the benefits these provide to developers in supporting graphics intensive games, which encourage new apps to be provided, which brings in new customers and generates revenue through app sales. As another example, improvements in smartphone cameras has led to an ever increasing set of applications and fueled the growth of image- and video-based social media services to the benefit of consumers. Given such complementarities, a line-by-line cost analysis of each platform feature in isolation, as Mr. Sweeney has done in the past,<sup>108</sup> is misguided as a matter of platform economics. It is the collective effect of the services and benefits a platform provides that bring developers and consumers together, facilitating the platform's ultimate product, transactions between the two.

67. Under Apple's revenue sharing approach, Apple covers the burden of the App Store and collects only a percentage payment when there is a transaction. This has multiple benefits, including:

- Developers can offer their apps for free, a common and important way in which digital goods are distributed. It takes advantage of the fact that digital

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<sup>106</sup> Schmalensee Declaration, ¶ 41 ("Second, there are clear indirect network effects here: consumers want access to good apps, developers want access to many potential customers. The success of the App Store in turn depends on the strength of these indirect network effects and how they are managed.").

<sup>107</sup> Schmalensee Declaration, ¶ 40 ("First, to be viable, the App Store needs to attract both consumers and developers. Apple notes that customers' decisions to purchase its hardware products depend in part on the availability of third-party software applications and services... Developing and marketing an operating system and handsets that enable developers to provide apps with high quality graphics and other attractive features and functionality helps attract both consumers and developers.").

<sup>108</sup> For example, see Brittney Vincent, "Epic Games' Tim Sweeney Explains Epic Games Store 12% Cut," *Variety*, April 23, 2019, available at <https://variety.com/2019/gaming/news/tim-sweeney-epic-games-store-1203195452/>, accessed on September 7, 2020 ("Why 12%? We chose this number to provide a super-competitive deal for partners while building an enduring and profitable store business for Epic...From that 12% we net around 5% after direct costs and that could grow to 6-7% with greater economies of scale.").



goods have near-zero marginal costs to solve other economic problems, such as developers otherwise having to incentivize consumers to download their app or seek reviews and publicity that would overcome consumers' hesitance to pay an initial price.<sup>109</sup>

- Apple collecting its commission upon completion of a paid download or in-app purchase is efficient because the payment transaction and the commission happen concurrently and rely on the same information. While Apple could instead, say, require every app provider to self-report sales, such a requirement would be burdensome to both Apple and developers, especially small developers who generate modest revenue. Given that Apple interacts with millions of developers, the cost of administering such a program and monitoring compliance would likely be large.
- Providing payment administration may be especially valuable in an environment like the App Store. For instance, the administration of sales tax across jurisdictions in the US by itself is recognized as a significant cost and barrier to small businesses competing online,<sup>110</sup> a problem that the App store addresses on a global scale.<sup>111</sup>

68. Under Apple's business model, Apple is also responsible for curating the apps available on the App Store. This curation system helps generate a better experience for consumers.<sup>112</sup> While Dr. Evans has thus far ignored the consumer value generated by this curated approach in the present case, he has not done so in his academic work. In a 2019 article of his, he writes:

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<sup>109</sup> For example, see Akerlof (1970), which demonstrates market failure arising from asymmetric information. In markets where buyers cannot distinguish high-quality products from low quality ones ("lemons"), theory suggests that in equilibrium the high-quality goods may be driven out of the market and some potential gains from trade can be lost. George Akerlof, "The market for 'lemons': Quality uncertainty and the market mechanism," *Uncertainty in economics*. Academic Press, 1978, pp. 235–251. Such issues may be especially important in the sale of information products. See Arrow, K. 1962. "Economic welfare and the allocation of resources for inventions." In *The Rate and Direction of Inventive Activity: Economic and Social Factors*, ed. R. R. Nelson, pp. 609–626, Princeton: Princeton University Press.

<sup>110</sup> For example, see "Sales Tax: Big Challenges for Small Business," *Intuit*, February 10, 2019, available at <https://intuittaxandfinancialcenter.com/sales-tax-big-challenges-for-small-business/>, accessed on September 10, 2020 ("Of all the responsibilities of running a small business, the obligation to collect and pay sales tax may not seem like such a big deal. But for a growing number of small business that conduct sales across state lines, the challenge is real and seems to get more complex every day.").

<sup>111</sup> Schiller Declaration, ¶ 4 ("Apple even helps developers navigate complicated foreign taxation systems by sorting through the requirements of different countries to assure that any required taxes are withheld.").

<sup>112</sup> Schiller Declaration, ¶¶ 20, 27 ("The foundation of the App Store is that consumers can safely and easily download apps for their iPhones and iPads that perform as promised, do not jeopardize the security of their devices, and offer the privacy protections that consumers have come to expect from Apple.... Since January 1, 2020, Apple has processed more than four million app submissions, approving approximately two thirds of them and rejecting approximately one third for non-compliance with the Guidelines and/or the agreements.").

“Many platforms, however, have developed governance structures— involving rules, enforcement, and punishment—to limit behavioural externalities which reduce platform value. Apple, for example, removes apps from its App Store, which is the only way to reach iPhone users, if developers ‘attempt to cheat the system (for example, by trying to trick the review process, steal user data, copy another developer’s work, or manipulate ratings)’.”<sup>113</sup>

69. Apple’s business model and app curation also benefits consumers in the form of enhanced security. The iPhone ecosystem is known to have significantly fewer problems with security and malware compared to the more open Android ecosystem.<sup>114</sup> Smartphones in general are also known to have significantly fewer problems with viruses and malware than PCs and Macs, despite the much more limited use of third-party antivirus and antimalware apps on smartphones.<sup>115</sup>

70. The empirical evidence suggests that consumers greatly value the safety and convenience afforded to them by Apple’s business model. During this dispute, Epic for a brief period added the ability to purchase in-app content in Fortnite for iOS either as standard iOS in-app purchase or using an Epic “Direct Pay” option. Epic offered consumers a 20 percent discount if they circumvented the standard in-app purchase system. Per Epic, 46.6 percent of consumers who made a purchase during this time period continued to use the standard in-app purchase system instead.<sup>116</sup> This shows that, despite Epic’s marketing and display bias (i.e., the advantage due to

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<sup>113</sup> David Evans, “Basic principles for the design of antitrust analysis for multisided platforms,” *Journal of Antitrust Enforcement* 7, no. 3, 2019, pp. 319–338 at 324.

<sup>114</sup> Kari Paul, “Apple or Android? Here is the most secure phone you can get,” *MarketWatch*, January 6, 2019, available at <https://www.marketwatch.com/story/apple-or-android-here-is-the-most-secure-phone-you-can-get-2018-10-10>, accessed on September 9, 2020 (“Android collects and sells more data to advertisers, but which devices are less vulnerable to hacking? Apple once again, said Ortega [a website security analyst at Scottsdale, Ariz.-based cloud-based security firm SiteLock]... ‘Because Android prides itself on being open-source to a degree, their Play store is much easier to get apps added to and this has resulted in malicious apps slipping past security screenings,’ Ortega said”).

<sup>115</sup> Trent Gillies, “Cell phones a harder hack target than computers, FireEye’s President says,” *CNBC*, April 19, 2015, available at <https://www.cnn.com/2015/04/19/cell-phones-a-harder-hack-target-than-computers-fireeyes-president-says.html>, accessed on September 9, 2020 (“In the cyberwar against hackers, your phone could actually be safer than your computer. That’s coming from a top cybersecurity executive who tells CNBC that cell phones make a harder target”); and Christina Gough, “Share of respondents using antivirus or internet security software in the United States from 1st half 2016 to 2nd half 2017, by device,” *Statista*, available at <https://www.statista.com/statistics/831577/us-usage-of-antivirus-software-by-device/>, accessed on September 9, 2020.

<sup>116</sup> Sweeney Declaration, p. 7:25–28 (“From August 13 to August 27, 2020 (essentially the period during which users could choose between Epic’s direct pay option and Apple’s IAP), 53.4% of iOS Fortnite players who made an in-app purchase chose to use Epic’s direct payment, while 46.6% continued to use only Apple’s IAP.”).

Epic listing its option as the first option),<sup>117</sup> nearly half of all consumers valued Apple's platform services enough to overcome a 20 percent price differential.<sup>118</sup>

***5.2. Epic's alternative monetization suggestions for Apple are severely flawed and likely to harm consumers and developers, as well as stifle innovation in the App Store***

71. Epic argues that, should it prevail, Apple could get paid for distribution by charging a flat fee or a per-download fee.<sup>119</sup> Epic appears to recognize, then, that if Apple is forced to change the way that it runs its platform, Apple would have to find alternative methods to generate revenue. Indeed, charges for the types of services that Apple provides without a fee separate from its commission are not uncommon. For instance, Apple provides two incidents of technical support per year without an additional fee,<sup>120</sup> while other vendors charge for technical support from the first incident.<sup>121</sup> Changes to Apple's monetization of the App Store ecosystem could thus induce changes in Apple's support model or its incentives to invest in features or capabilities of value to developers (including Epic). Epic's proposals in particular are likely to significantly harm consumers and developers.

72. For purposes of understanding the complex incentives of the iOS platform and highlighting the broader impact of Epic's motion, I consider the likely impact of one of Epic's suggested outcomes: Apple charging "a flat fee or a per-download fee."<sup>122</sup> Epic has not precisely explained what this would entail. For discussion purposes, I assume that by "flat fee" Epic means that Apple might eliminate developers' ability to

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<sup>117</sup> See Complaint, ¶ 18. The image shown displays Epic direct payment above Apple App Store, at a price differential of 20%.

<sup>118</sup> See, for example, Copeland, Duncan G., and James L. McKenney. "Airline reservations systems: lessons from history." *MIS quarterly* (1988): 353-370.

<sup>119</sup> Epic Motion for Preliminary Injunction, p. 22:11–12 ("...there are many ways that Apple could get paid for distribution that do not foreclose the iOS In-App Payment Processing Market, such as charging a flat fee or a per-download fee.").

<sup>120</sup> Apple Developer Program, "Membership Details," available at <https://developer.apple.com/programs/whats-included/>, accessed on September 15, 2020 ("Request code-level support from technical support engineers who can help troubleshoot your app's code or provide solutions that will fast-track your development. Two incidents per membership year are included. Any member of a team can purchase additional support for \$99 per two incidents.").

<sup>121</sup> For example, see Microsoft, "Support for business," February 28, 2019, available at <https://support.microsoft.com/en-us/help/4341255/support-for-business>, accessed on September 9, 2020 ("If you need immediate technical support for your business, Professional Support is available as a single pay-per-incident (PPI) or a 5-pack of incidents").

<sup>122</sup> Epic Motion for Preliminary Injunction, p. 22:7–12 ("But Epic does not want or need Apple to provide it with distribution or payment processing services, for free or otherwise. Epic wants to utilize its own competing services, for its own apps and for others. If and when Epic prevails, Apple would no longer provide it with either service, and therefore would not be entitled to any payment from Epic. And of course, there are many ways that Apple could get paid for distribution that do not foreclose the iOS In-App Payment Processing Market, such as charging a flat fee or a per-download fee.").



offer their apps for free, perhaps instituting a minimum non-zero price for any initial app download. Similarly, I assume that a “per-download fee” means that consumers downloading files from the App Store would pay a fee, potentially not just for an initial download but also every time they want to re-download or update one of the apps they have already purchased.

73. Under Apple’s existing business model, 84 percent of all apps in the Apple App Store in 2020 are completely free to download, re-download, and update as the developer sees fit.<sup>123</sup> Aside from the developer program fee, which even Dr. Evans acknowledges is nominal,<sup>124</sup> developers today do not pay an incremental fee for the ability to create, submit, distribute and update their apps, or to monetize their apps in a variety of different ways. Similarly, consumers currently pay nothing beyond the price of their iPhone or iPad for access to the App Store or for downloading free apps. Epic proposes to disrupt this arrangement, which affects nearly all consumers and most developers, for Epic’s private benefit.

74. Such disruption can significantly harm consumers and developers if it becomes no longer economic to continue to offer the same breadth of free apps or to pursue business models predicated on free downloads. Under either “flat fee” or “per-download fee” pricing as defined above, apps that are now available for free would be subject to a fee. In such a scenario, consumers would either have to pay additional fees or may never try out many apps. Under “per-download fee” pricing, updates would also be subject to a fee. In such a scenario, consumers would have to pay additional fees and many consumers may choose to not regularly update their apps. This may in fact exacerbate the connectivity issues in the Fortnite user base that Epic is objecting to.<sup>125</sup>

75. Epic also suggests that Apple should consider eliminating commissions because it generates significant revenues in the sale of devices.<sup>126</sup> This argument is

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<sup>123</sup> Apple Counterclaim Reply, p. 10:10–11 (“...Apple receives no revenue from 84% of apps distributed through the App Store, and billions of apps are downloaded every day without Apple receiving a penny.”).

<sup>124</sup> Evans Declaration, ¶ 18. (“As is the case with other software platforms, developers pay Apple and Google nothing or nominal fees for access to tools developers rely on to write compatible smartphone apps. Apple makes access to its software development kits available for free. For access to its developer program, which provides additional rights, Apple charges an annual fee of \$99 (or \$299 for an enterprise account intended for the distribution of apps for internal use within an organization).”).

<sup>125</sup> Epic Motion for Preliminary Injunction, p. 3:16–20 (“*Fortnite* is more than just a game. It is an intensely social community whose value to its users depends in large part on the ability to connect with other users. Epic has built a community that people rely on. By removing *Fortnite* from the App Store, Apple has cleaved millions of users from their friends and family in the *Fortnite* community, which entirely depends on connectivity.”).

<sup>126</sup> Epic Motion for Preliminary Injunction, p. 21:10–15 (“As relevant here, Apple does three separate things: it develops and maintains the iOS operating system; it distributes apps through the App Store; and it processes in-app payments for digital content through IAP. For the development and maintenance of iOS, like other platform

economically unjustified. The analysis of competitive behavior is based on the *incentives* generated by the participants of the platform, not on whether money is also generated elsewhere. Eliminating Apple's ability to generate revenue for the numerous services it provides to facilitate transactions on the App Store would mean that Epic and other developers would effectively be free riding. This would reduce Apple's incentives to invest in App Store services, which in turn would lead to fewer developer and consumer benefits over time. Alternatively, as Professor Schmalensee explains, Apple monetizing solely through the sale of devices is likely to require a price increase, which may harm price-sensitive consumers.<sup>127</sup>

76. If Epic's logic is applied to platforms generally (potentially including Fortnite), the implication is that any platform that is associated with one stream of revenue should be willing to forego any other revenue stream they currently receive, ignoring the complexities and business decisions that led to their current pricing structure.

77. Epic also disregards the iPhone's security benefits, which flow from the business model that Epic's proposals would likely disrupt. Epic fails to recognize that smartphones differ from other markets such as PCs or Mac desktops and laptops. In its filings, Epic treats Apple's concerns about security and privacy as pretextual.<sup>128</sup> Dr. Evans addresses neither security nor privacy, except in the narrow context of payment processing regulation.<sup>129</sup> Smartphones have access to a much greater array of user information than PCs, including not only financial and personal data, images, and contacts but also records of all of a user's movements and locations – information that is not as prevalent on other platforms.<sup>130</sup> These considerations weigh in favor of the Apple approach of a carefully curated system to an alternative approach where there are fewer restrictions regarding apps. Even on Android, which places fewer restrictions on alternative app stores and allows app distribution outside of any app store, most consumers choose to obtain their apps through the

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developers, Apple gets paid in a host of ways not at issue here, including primarily through its sale of iOS devices. But creating the iOS platform does not also entitle Apple to compensation for app distribution and in-app payment processing services.”).

<sup>127</sup> Schmalensee Declaration, ¶ 58 (“Monetization solely through the sale of hardware, for instance, would likely require a price increase, which would reduce sales to price-sensitive consumers.”).

<sup>128</sup> For example, see Complaint, ¶ 83 (“Apple has asserted that blocking third-party app distribution platforms is necessary to enforce privacy and security safeguards. This is a pretext that Apple has used to foreclose *all* competition in the iOS App Distribution Market in which it has absolute monopoly power”).

<sup>129</sup> Evans Declaration, ¶ 63 (“Developers look for processors that...comply with regulatory and data security and privacy requirements...”).

<sup>130</sup> Schiller Declaration, ¶ 25 (“Virtually every individual's mobile phone houses all of the contact information for their friends and family, personal photographs, credit card and bank account information, and a record of the consumer's movements and current location.”).

Google Play Store.<sup>131</sup> Google has also increasingly moved toward a model of greater app curation in order to be more competitive with Apple.<sup>132</sup>

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct, and that I executed this declaration on the 15th of September, 2020, in Villanova, Pennsylvania.




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Lorin M. Hitt, Ph.D.

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<sup>131</sup> Google, “Alternative distribution options,” April 16, 2020, available at <https://developer.android.com/distribute/marketing-tools/alternative-distribution>, accessed on September 9, 2020 (“You can distribute your Android apps to users in any way you want...From publishing in an app marketplace to serving your apps from a website or emailing them directly to users, you’re never locked into any particular distribution platform...Google Play is the premier marketplace for Android apps...However, you can distribute your apps through any app marketplace you want or use multiple marketplaces.”); and Tim Fisher, “Is Google Play Safe?” *Lifewire*, March 6, 2020, available at <https://www.lifewire.com/is-google-play-safe-153675>, accessed on September 9, 2020 (“For most people, Google Play is their first stop when finding new apps to download to their Chromebook or Android device, and for good reason.”). Directly downloading apps outside the Google Play Store on an Android device is called “sideloading.” Sideloading an app comes with risks. The app has not been verified as authentic or not containing malicious software. See John Hoff, “HOW TO: Sideloading apps on your Android device,” *Android Community*, April 17, 2018, available at <https://androidcommunity.com/how-to-sideloading-apps-on-your-android-device-20180417/>, accessed on September 14, 2020 (“‘Sideloading’ is just Android geekspeak for installing an app outside of the Play Store...Google asks users to always install from the Play Store if possible because they can at least ensure that the Google Play Protect security system is at work in that process, filtering malicious apps before they are even installed. When installing from other sources, you will get no such protection. Hence, you have to be really sure that the APK you are sideloading comes from a legit and non-malicious source.”). Mr. Sweeney acknowledges the risks. He encouraged users to “...look carefully at the source of software you’re installing, and only install software from sources you trust.” See Richard Leadbetter, “The rumours are true – Fortnite on Android doesn’t use Google Play,” *Eurogamer*, August 3, 2018, available at <https://www.eurogamer.net/articles/digitalfoundry-2018-fortnite-on-android-doesnt-use-google-play-confirmed>, accessed on September 9, 2020.

<sup>132</sup> Tim Fisher, “Is Google Play Safe?” *Lifewire*, March 6, 2020, available at <https://www.lifewire.com/is-google-play-safe-153675>, accessed on September 9, 2020 (“When compared to Apple’s App Store, Google Play’s track record with malware is less than stellar mainly because Google and Apple have very different approaches to apps...Finally, a human review process for apps was implemented in 2016, and deeper app reviews began in 2019 for developers that don’t yet have a track record with Google.”); and Andy Greenberg, “How Spies Snuck Malware Into the Google Play Store—Again and Again,” *Wired*, April 28, 2020, available at <https://www.wired.com/story/phantomlance-google-play-malware-apt32/>, accessed on September 9, 2020 (“But the PhantomLance operation is particularly disturbing because it shows that even after Google removed much of OceanLotus’s spyware from Google Play, it didn’t detect at least two of the malicious apps, says Kaspersky’s Kurt Baumgartner. ‘Even after this group had been reported as active on Google Play, they were still active and hosting viable variants into late 2019,’ Baumgartner says. ‘To me, this says something about the walled garden approach—and how confidence in walled gardens is shaken.’”).

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Massachusetts Institute of Technology	Ph.D. Management (1996) Concentration in Information Technology and Economics Dissertation Title: “Economic Analysis of Information Technology and Organization” Committee: Erik Brynjolfsson (MIT, chair), Zvi Griliches (Harvard), Thomas W. Malone (MIT)
Brown University	M.S. Electrical Engineering (1989)
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University of Pennsylvania, Wharton School, Philadelphia, PA. *Zhang Jindong Professor, Operations, Information and Decisions Department (formerly OPIM) (2015-present).*

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University of Pennsylvania, Wharton School, Philadelphia, PA. *Professor of Operations and Information Management, Department of Operations and Information Management (2013-2014).*

University of Pennsylvania, Wharton School, Philadelphia, PA. *Class of 1942 Professor (Term Chair), Department of Operations and Information Management (2008-2013).*

University of Pennsylvania, Wharton School, Philadelphia, PA. *Alberto Vitale Term Associate Professor of Operations and Information Management (2002-2008).*

University of Pennsylvania, Wharton School, Philadelphia, PA. *Alberto Vitale Term Assistant Professor of Operations and Information Management (2000-2002).*

University of Pennsylvania, Wharton School, Philadelphia, PA. *Assistant Professor of Operations and Information Management (1996-2000).*

Massachusetts Institute of Technology, Industrial Performance Center, Cambridge, MA. *Graduate Fellow (1995-1996).*

Massachusetts Institute of Technology, Center for Coordination Science, Cambridge, MA.  
*Research Assistant (1992-1996).*

Brown University, Department of Engineering, Providence, RI and IBM T.J. Watson Research Center, Yorktown Heights, NY. *Graduate Research Assistant (1988-89).*

Brown University, Department of Engineering, Providence, RI. *Research Assistant (1987-88).*

Oliver Wyman and Company, New York, NY. *Consultant (1989-1992).*

Harry Diamond Laboratories, Adelphi, MD. *Engineering Technician (1984-87).*

### Articles Published in Refereed Journals

1. Wu, Lynn, Hitt, Lorin M. and Bowen Lou (2020). "Data Analytics Skills, Innovation and Firm Productivity," *Management Science* 66(5): 1783-2290.
2. Wu, Lynn, Hitt, Lorin M. and Bowen Lou (2019). "Data Analytics Supports Decentralized Innovation Communities," *Management Science* 65(10): 4451-4949.
3. Bavafa, Hessam and Hitt, Lorin M. and Terwiesch, Christian (2018), "The Impact of E-Visits on Visit Frequencies and Patient Health: Evidence from Primary Care," *Management Science* 64(12): 5461-5959.
4. Tan, Fangyun, Netessine, Sergei and Lorin M. Hitt (2017). "Is Tom Cruise Threatened? An Empirical Study of the Impact of Product Variety on Demand Concentration," *Information Systems Research* 28(3): 643-660.
5. Avgar, Ariel, Tambe, Prasanna and Lorin M. Hitt (2018). "Built to Learn: How Work Practices Affect Employee Learning During Healthcare Information Technology Implementation," *MIS Quarterly* 42(2): 645-659 (a previous version appeared as "The Effects of Organizational Factors on Healthcare IT Adoption Costs: Evidence from New York Nursing Homes," *Proceedings of the 2009 Hawaii International Conference on Systems Sciences: HICSS-43.*).
6. Wu, Lynn, Jin, Fujie and Lorin M. Hitt (2018). "Are All Spillovers Created Equal? A Network Perspective on IT Labor Movement," *Management Science* 64(7): 2973-3468. (A previous version appeared as: Wu, Lynn, Jin, Fujie and Lorin M. Hitt (2014). "Are All Spillovers Created Equal? A Network Perspective on IT Labor Movements," *Proceedings of the 33<sup>rd</sup> Annual International Conference on Information Systems.*)
7. Hitt, Lorin M. and Prasanna Tambe (2016). "Health Care Information Technology, Work Organization and Nursing Home Performance," *ILR Review* (69): 834-859.
8. Tambe, Prasanna and Lorin M. Hitt (2014). "Measuring Information Technology Spillovers," *Information Systems Research* 25(1):53-71. (A previous version appeared as: Hitt, Lorin M. and Sonny Tambe (2006). "Measuring Spillovers from Information Technology Investments," *Proceedings of the 25<sup>th</sup> Annual International Conference on Information Systems*)
9. Tambe, Prasanna and Lorin M. Hitt (2014). "Job Hopping, Information Technology Spillovers and Productivity Growth," *Management Science* 60(2): 338-355. (A previous version appeared as: Tambe, Sonny and Lorin M. Hitt (2010). "Job Hopping, Knowledge



Spillovers, and Regional Returns to Information Technology Investments,” *Proceedings of the 29<sup>th</sup> Annual International Conference on Information Systems*.) (Finalist, Management Science Best Paper Award IS Area, 2015; Winner Management Science Best Paper Award IS Area, 2016).

10. Wu, D.J., Ding, Ming, and Lorin M. Hitt (2013). “IT Implementation Contract Design: Analytical and Experimental Investigation of IT Value, Learning and Contract Structure,” *Information Systems Research* 24(3). 787-801 (A previous version appeared as: Wu, D.J., Ding, Min and Lorin M. Hitt (2003). “Learning in ERP Contracting: A Principal-Agent Analysis,” *Proceedings of the 37<sup>th</sup> Annual Hawaii International Conference on System Sciences*, Honolulu, HI.)
11. Gao, Gordon and Lorin M. Hitt (2012) “IT and Trademarks: Implications for Product Variety” *Management Science* 58(6): 1211-1226. [A previous version appeared as: Gao, Gordon and Lorin M. Hitt (2004). “IT and Product Variety: Evidence from Panel Data,” *Proceedings of the 25<sup>th</sup> Annual International Conference on Information Systems*, Washington, D.C. (Runner-up – Best Paper Award)]
12. Tambe, Prasanna and Lorin M. Hitt (2012). “Information Technology and Productivity 1987-2006: Evidence from New Firm-Level Data,” *Information Systems Research* 23(9):599-617. (Winner of the ISR 2013 Best Paper Award).
13. Field, Joy, Xue, Mei and Lorin M. Hitt (2012) “Learning by customers as co-producers in financial services: An empirical study of the effects of learning channels and customer characteristics,” *Operations Management Research* 4(1-2), June: 43-56.
14. Tambe, Prasanna and Lorin M. Hitt (2012). “Now IT’s Personal: Offshoring and the Shifting Skill Composition of the US Information Technology Workforce,” *Management Science* 58(4): 678-695. [A previous version appeared as: Tambe, Sonny and Lorin M. Hitt (2010). “Now IT’s Personal: Offshoring and the Shifting Skill Composition of the US Information Technology Workforce,” *Proceedings of the 29<sup>th</sup> Annual International Conference on Information Systems*] (Finalist, Management Science Best Paper Award IS Area, 2014).
15. Tambe, Prasanna, Hitt, Lorin M. and Erik Brynjolfsson (2012). “The Extroverted Firm: How External Information Practices Affect Productivity,” *Management Science* 58(5): 843-859. [A prior version appeared as: Tambe, Sonny, Hitt, Lorin M. and Erik Brynjolfsson (2008). “The Extroverted Firm,” *Proceedings of the 27<sup>th</sup> Annual International Conference on Information Systems*] (Runner-Up, INFORMS Times Best Paper Award, 2017)
16. Li, Xinxin, Hitt, Lorin M. and Z. John Zhang (2011). “Product Reviews and Competition in Markets for Repeat Purchase Products,” *Journal of Management Information Systems* 27(4): 9-42.
17. Hitt, Lorin M, Xue, Mei, and Pei-Yu Chen (2011). “The Determinants and Outcomes of Internet Banking Adoption,” *Management Science* 57(2): 291-307.
18. Li, Xinxin and Lorin M. Hitt (2010). “Price Effects in Online Product Reviews: An Analytical Model and Empirical Analysis,” *MIS Quarterly* 34(4): 809-831.
19. Tambe, Prasanna and Lorin M. Hitt (2010). “How Does Offshoring Affect IT Workers?” *Communications of the ACM* 53(10): 72-82.
20. Li, Xinxin and Lorin M. Hitt (2008). “Self Selection and the Information Role of Product Reviews,” *Information Systems Research* 19(4): 456-474.

21. Wu, Shin-Yi, Hitt, Lorin, Chen, Pei-Yu, and G. Anandalingam (2008) "Customized Bundle Pricing for Information Goods: A Nonlinear Mixed Integer Programming Approach," *Management Science* 54(3): 608-622.
22. Hitt, Lorin M. and Sonny Tambe (2007) "Broadband Adoption and Content Consumption," *Information Economics and Policy* 19(3-4): 362-378.
23. Xue, Mei, Hitt, Lorin M. and Patrick T. Harker (2007). "Customer Efficiency, Channel Usage and Firm Performance in Retail Banking," *Manufacturing and Service Operations Management* (9): 535-558.
24. Eric K. Clemons, Gao, Gordon and Lorin M. Hitt (2006). "When Online Reviews Meet Hyperdifferentiation: A Study of the Craft Beer Industry," *Journal of Management Information Systems* 23(2): 149-171 (a previous version appeared in the *Proceedings of the 37<sup>th</sup> Annual Hawaii International Conference on System Sciences*, Honolulu, HI).
25. Jacobides, Michael G. and Lorin M. Hitt (2005). "Vertical Scope, Revisited: Transaction Costs vs. Capabilities and Profit Opportunities in Mortgage Banking," *Strategic Management Journal* 26(13): 1209-1227.
26. Hitt, Lorin M. and Pei-Yu Chen (2005). "Bundling with Customer Self-Selection: A Simple Approach to Bundling Low Marginal Cost Goods," *Management Science* 51(10): 1481-1493.
27. Clemons, Eric K. and Lorin M. Hitt (2004). "Poaching and the Misappropriation of Information: Transaction Risks of Information Exchange," *Journal of Management Information Systems* 21(2): 87-108. [An earlier version appeared as: Clemons, Eric K. and Lorin M. Hitt (2003). "Poaching and the Misappropriation of Information: Transaction Risks of Information Exchange," *Proceedings of the 37<sup>th</sup> Annual Hawaii International Conference on System Sciences*, Honolulu, HI.]
28. Snir, Eli and Lorin M. Hitt (2004). "Vendor Screening in Information Technology Contracting with a Pilot Project," *Journal of Organizational Computing and Electronic Commerce* 14(1): 61-88. [An earlier version of this paper appeared as Snir, Eli and Lorin M. Hitt (1999), "Vendor Screening in IT Contracting with a Pilot Project (extended abstract)," *Proceedings of the 20<sup>th</sup> Annual International Conference on Information Systems*, Charlotte, N.C.: 324-327. (Runner-up for Best Paper Award).]
29. Snir, Eli and Lorin M. Hitt (2003). "Costly Bidding in Online Markets for IT Services," *Management Science* 49(11): 1504-1520.
30. Brynjolfsson, Erik and Lorin M. Hitt (2003) "Computing Productivity: Firm-Level Evidence," *Review of Economics and Statistics* 85(4): 793-808.
31. Brynjolfsson, Erik, Hitt, Lorin M. and Shinkyu Yang (2002) "Intangible Assets: Computers and Organizational Capital," *Brookings Papers on Economic Activity* (1): 137-199. [An earlier version of this paper appeared as Brynjolfsson, Erik, Hitt, Lorin M. and Shinkyu Yang (1998) "Intangible Assets: How the Interaction of Computers and Organizational Structure Affects Stock Market Valuations", *Proceedings of the 19<sup>th</sup> Annual International Conference on Information Systems*, Helsinki, Finland: 8-29.].
32. Chen, Pei-Yu and Lorin M. Hitt (2002) "Measuring Switching Costs and Their Determinants in Internet Enabled Businesses: A Study of the Online Brokerage Industry," *Information Systems Research* 13(3): 255-276. [An earlier version of this paper appeared as Chen, Pei-Yu and Lorin M. Hitt (2000) "Switching Cost and Brand Loyalty in Electronic Markets: Evidence from On-Line Retail Brokers," *21<sup>st</sup> Annual International Conference on Information Systems*, Brisbane, Australia: 134-144.]

33. Hitt, Lorin M., Wu, D.J. and Xiaoge Zhou (2002). "Investment in Enterprise Resource Planning: Business Impact and Productivity Measures," *Journal of Management Information Systems* (Special Issue on ERP) 19(1): 71-98.
34. Hitt, Lorin M. and Frances X. Frei (2002). "Do Better Customers Utilize Electronic Distribution Channels? The Case of PC Banking," *Management Science* 48(6, June): 732-749.
35. Clemons, Eric K., Hann, Il-Horn, and Lorin M. Hitt (2002). "Price Dispersion and Differentiation in Online Travel: An Empirical Investigation," *Management Science* 48(4, April): 534-550.
36. Bresnahan, Timothy, Brynjolfsson, Erik and Lorin M. Hitt (2002). "Information Technology, Workplace Organization and the Demand for Skilled Labor: Firm-level Evidence," *Quarterly Journal of Economics*, 117(1): 339-376. [Reprinted as "Tecnología de la Información, Organización del Lugar de Trabajo y Demanda de Trabajadores Calificados: Evidencia a Partir de Datos de Empresa," Chapter 8 in *Reformas Y Equidad Social En America Latina Y El Caribe* (Carlos Eduardo Velez and Pax Castillo-Ruiz, eds.) Banco Interamericano de Desarrollo: 135-168 (2004). An earlier version of this paper appeared as Bresnahan, Timothy, Brynjolfsson, Erik and Lorin M. Hitt (2000) "Technology, Organization and the Demand for Skilled Labor," Chapter 5 in *The New Relationship: Human Capital in the American Corporation* (Margaret M. Blair and Thomas A. Kochan, eds.), Brookings Institution Press: 145-193.]
37. Clemons, Eric K., Hitt, Lorin M., Gu, Bin, Thatcher, Matt E. and Bruce W. Weber (2002). "Impacts of eCommerce and Enhanced Information Endowments on Financial Services: A Quantitative Analysis of Transparency, Differential Pricing and Disintermediation," *Journal of Financial Services Research* 22(1,2): 73-90.
38. Brynjolfsson, Erik and Lorin M. Hitt (2000). "Beyond Computation: Information Technology, Organizational Transformation and Business Performance." *Journal of Economic Perspectives*, 14(4): 23-48. [Reprinted as Brynjolfsson, Erik and Lorin M. Hitt (2004). "Information Technology, Organizational Transformation and Business Performance," Chapter 2 in *Productivity, Inequality and the Digital Economy* (Nathalie Greenan, Yannick L'Horty and Jacques Mairesse, eds.) , MIT Press: 55-91. Also reprinted as Chapter 4 in *Inventing Organizations of the 21<sup>st</sup> Century* (Thomas Malone, Robert Laubacher and Michael S. Scott Morton, eds): 70-99.]
39. Hitt, Lorin M. (1999). "Information Technology and Firm Boundaries: Evidence from Panel Data," *Information Systems Research*, 10(2, June): 134-149.
40. Brynjolfsson, Erik and Lorin M. Hitt (1998). "Beyond the Productivity Paradox," *Communications of the ACM*, 41(8): 49-55.
41. Hitt, Lorin M. and Erik Brynjolfsson (1997). "Information Technology and Internal Firm Organization: An Exploratory Analysis," *Journal of Management Information Systems* 14 (2): 81-101.
42. Brynjolfsson, Erik and Lorin M. Hitt (1996). "Paradox Lost? Firm-Level Evidence on the Returns to Information Systems," *Management Science* 42 (4): 541-558. [reprinted as Section 1 Chapter 1 in *Beyond the IT Productivity Paradox*, (Leslie Willcocks and Stephanie Lester, eds.), John Wiley and Sons: 39-68 (1999) and Section 2 Chapter 1 in *Exploring Information Systems Research Approaches*, (Robert D. Galliers, M. Lynne Markus and Sue Newell, eds.), Routledge: 109-127 (2007). An earlier version of this paper appeared as Brynjolfsson, Erik and Lorin M. Hitt (1993) "Is Information Systems Spending Productive? New Evidence and New Results," *Proceedings of the 14th Annual International Conference*



on Information Systems, Orlando, FL. December: 47-64.]. Winner of the Best Paper Award in Information Systems Economics in last seven years (1999 Workshop on Information Systems and Economics).

43. Hitt, Lorin M. and Erik Brynjolfsson (1996). "Productivity, Business Profitability, and Consumer Surplus: Three Different Measures of Information Technology Value," *MIS Quarterly* 20(2): 121-142. Winner of 1996 Best Paper award. [An earlier version of this paper appeared as Hitt, Lorin M. and Erik Brynjolfsson (1994) "The Three Faces of IT Value: Theory and Evidence," *Proceedings of the 15th Annual International Conference on Information Systems*, Vancouver, B.C., December. (Winner of Best Paper and Best Paper Addressing Conference Theme Awards): 263-277.]
44. Brynjolfsson, Erik and Lorin M. Hitt (1995) "Information Technology as a Factor of Production: The Role of Differences Among Firms", *Economics of Innovation and New Technology* 3-4: 183-199.
45. Martin, Suzanne, Hitt, Lorin M., and James Rosenberg (1989) "p-Channel Germanium MOSFETs with High Channel Mobility," *IEEE Electron Device Letters* 10(7, July): 325-326.

#### **Refereed Conference Proceedings (Not otherwise published in Journals)**

46. Wu, Lynn, Jin, Fujie and Lorin M. Hitt (2015). "How Do Data Skills Affect Firm Productivity: Evidence from Process-driven vs. Innovation-driven Practices," *Proceedings of the 34<sup>th</sup> Annual International Conference on Information Systems*.
47. Wu, Lynn, Jin, Fujie and Lorin M. Hitt (2015). "Data Skills and the Value of Social Media: Evidence from Large-Sample Firm Value Analysis," *Proceedings of the 34<sup>th</sup> Annual International Conference on Information Systems*. (Updated version: SSRN 2826115)
48. Hong, Yili, Chen, Pei-Yu, and Lorin M. Hitt (2012). "Measuring Product Type with Dynamics of Online Review Variance: Implications for Research and Practice," *Proceedings of the 31<sup>st</sup> Annual International Conference on Information Systems* (runner-up best paper award). (Updated version: SSRN 2422686) (Conditionally accepted, *Information Systems Research*, 2020)
49. Tambe, Sonny, Hitt, Lorin M. and Erik Brynjolfsson (2011) "The Price and Quantity of IT-Related Intangible Capital," *Proceedings of the 30<sup>th</sup> Annual International Conference on Information Systems*.
50. Gao, Gordon and Lorin M. Hitt (2003). "The Economics of Telecommuting: Theory and Evidence," *Proceedings of the 24<sup>th</sup> Annual International Conference on Information Systems*, Seattle, WA.
51. Chen, Pei-Yu and Lorin M. Hitt (2001) "Brand Awareness and Price Dispersion in Electronic Markets," *22<sup>nd</sup> Annual International Conference on Information Systems*, New Orleans, LA.
52. Gu, Bin and Lorin M. Hitt (2001) "Transactions Costs and Market Efficiency," *22<sup>nd</sup> Annual International Conference on Information Systems*, New Orleans, LA.

#### **Other Publications**

##### ***Chapters in Books***

53. Chen, Pei-Yu and Lorin M. Hitt (2007). "Information Technology and Switching Costs," in T. Hendershott, ed., *Handbook of Information Systems Economics*.
54. Brynjolfsson, Erik and Lorin M. Hitt (2005) "Intangible but not Unmeasurable: Some Thoughts on the Measure and Magnitude of Intangible Assets," in Carol Corrado and Daniel Sichel, eds., *Measuring Capital in the New Economy*, University of Chicago Press (for NBER).
55. Brynjolfsson, Erik and Lorin M. Hitt (2005) "Intangible Assets and the Economic Impact of Computers," in William Dutton, Brian Kahin, Ramon O'Callaghan, and Andrew Wyckoff, eds., *Transforming Enterprise*, MIT Press.
56. Clemons, Eric K., Hitt, Lorin M. and David C. Croson (2001) "The Future of Retail Financial Services: Transparency, Bypass and Differential Pricing," Chapter 4 in *Tracking a Transformation: E-commerce and the Terms of Competition in Industries* (J. Zysman, ed.), Brookings Institution Press: 92-111.
57. Clemons, Eric K. and Lorin M. Hitt (2001) "Financial Services: Transparency, Differential Pricing and Disintermediation," Chapter 4 in *The Economic Payoff from the Internet Revolution* (R. Litan and A. Rivlin, eds.), Brookings Institution Press: 87-128.
58. Hitt, Lorin M., Frei, Frances X. and Patrick T. Harker. (1999) "How Financial Firms Decide on Technology," Chapter 3 in *Brookings/Wharton Papers on Financial Services:1999*, Litan, Robert E. and Anthony M. Santomero, Eds. Washington, DC: Brookings Institution Press: 93-136.
59. Hitt, Lorin M. (1999). "The Impact of IT Management Practices on the Performance of Life Insurance Companies," Chapter 7 in *Changes in the Life Insurance Industry: Efficiency, Technology and Risk Management* (J. David Cummins and Anthony M. Santomero, eds.), Norwell, MA: Kluwer Academic Publishers: 211-243.

#### **Trade Journal Publications**

60. Brynjolfsson, Erik and Lorin M. Hitt (1997) "Breaking Boundaries", *InformationWeek* 500 September 22: 54-61.
61. Brynjolfsson, Erik and Lorin M. Hitt (1996) "The Customer Counts," *InformationWeek*, September 8: 38-43.
62. Brynjolfsson, Erik and Lorin M. Hitt (1995) "The Productive Keep Producing," *InformationWeek*, September 18: 38-43.

#### **Books**

63. Ferguson, Matthew, Hitt, Lorin and Prasanna Tambe. *The Talent Equation*. McGraw Hill, 2013.

#### **Reports**

64. Ahluwalia, Simran, Caulfield, Matthew, Davidson, Leah, Diehl, Mary Margaret, Ipsas, Aline, Windle, Michael and Lorin M. Hitt (2017). *The Business of Voting*. Wharton Public Policy Issue Industry Report. (<https://publicpolicy.wharton.upenn.edu/business-of-voting/>)
65. Hitt, Lorin M. and Prasanna Tambe (2011). Technical Report: The Business Case for Healthcare Information Technology in Nursing Homes. White Paper (SSRN 1964841)
66. Beard, Nick, Elo, Kinga Z., Hitt, Lorin M. and Michael G. Housman (2007). The Economics of IT and Hospital Performance. Pricewaterhouse Coopers White Paper ([http://www.pwc.com/us/en/technology-innovation-center/assets/healthindex\\_web-x.pdf](http://www.pwc.com/us/en/technology-innovation-center/assets/healthindex_web-x.pdf))

67. Hitt, Lorin, Wu, Lynn, Campbell, Karen, Jeafarqomi, Karim, Ashtiani, Hamid and Leslie Levesque. "Corporate Data Literacy: Scoring Firms and Firm Performance," IHS Market White Paper, September 2018.

### ***Working Papers***

68. Yapar, Ozge, Lobel, Ruben and Lorin M. Hitt (2017). "Technology Sharing in Two Sided Markets." Working Paper.
69. Jin, Fujie, Wu, Andy and Lorin Hitt (2017). "Social is the New Financial: How Startup Social Media Activity Influences Funding Outcomes," Mack Center Working Paper, Wharton School ([https://mackinstitute.wharton.upenn.edu/wp-content/uploads/2017/03/FP0331\\_WP\\_Feb2017.pdf](https://mackinstitute.wharton.upenn.edu/wp-content/uploads/2017/03/FP0331_WP_Feb2017.pdf))
70. Brynjolfsson, Erik, Hitt, Lorin M. and Heekyung Hellen Kim (2011). "Strength in Numbers: how Does Data-Driven Decisionmaking Affect Firm Performance?" Working Paper (SSRN 1919486)
71. Brynjolfsson, Erik, Hitt, Lorin M., Rock, Daniel and Prasanna Tambe (2019). "IT, AI and the Growth of Intangible Capital," Working Paper (SSRN 3416289).

### **Academic Honors**

Management Science, Information Systems Best Paper Award Finalist (2014, 2015, winner 2016)  
 Information Systems Research: Best Paper Award (2013)  
 Wharton Excellence in Teaching Award, Undergraduate Division (1998, 1999, 2000, 2001, 2003, 2007, 2008, 2012, 2013, 2018, 2019)  
 Best Paper in Information Systems and Economics (last 7 years), Workshop on Information Systems and Economics (1999)  
 Runner-up for Best Paper, International Conference on Information Systems (1999, 2004, 2012)  
 David Hauck Award for Distinguished Teaching, Wharton School (1999)  
 Christian R. and Mary F. Lindback Award for Distinguished Teaching, University of Pennsylvania (1998)  
 National Science Foundation CAREER Program Grant Recipient (1998)  
 Best Paper Award, Management Information Systems Quarterly (1996)  
 International Conference on Information Systems Doctoral Consortium (1995)  
 MIT Industrial Performance Center Doctoral Dissertation Fellowship (1995)  
 "Best Paper" and "Best Paper Addressing the Conference Theme" Awards at the International Conference on Information Systems (1994)  
 DuWayne J. Petersen Fellowship (1992-1996)  
 Honorable Mention, National Science Foundation Fellowship (1989)  
 Elected to Tau Beta Pi Engineering Society (1988)  
 Elected to Sigma Xi Scientific Research Society (1988)  
 Finalist, National Merit Scholarship Program (1985)  
 National Society of Professional Engineers' Scholarship (1985)  
 Honorable Mention, Westinghouse Science Talent Search (1985)

### **Grants**

Commonwealth Fund. The Business Case for Healthcare IT in Nursing Homes. (~\$150K) (1/08 – 12/13).

Co-Principal Investigator (with Mei Xue and Patrick Harker), National Science Foundation. Collaborative Research: Customer Efficiency and the Management of Multi-Channel Service Delivery Systems. Award: ~\$250K (8/05 – 8/07)

Wharton eBusiness Initiative/Mack Center, University of Pennsylvania, Wharton School. Product Reviews, Pricing and Market Strategy. Award: \$10K (5/05-11/05)

Fishman Davidson Center, University of Pennsylvania, Wharton School. Information Technology, Product Variety and Operations (6/2004-6/2005). Award: ~\$18K.

University Research Foundation. Information Technology and Product Variety; Data Development and Analysis. Award: \$18.5K (9/2004-5/2005)

Co-Principal Investigator (with Paul Kleindorfer and D.J. Wu), SAP America. Valuation of ERP in the Oil and Gas Industry. Award: \$40K (10/02-6/03)

Principal Investigator, NSF Grant IRI-9733877 (Computing and Social Systems Program): The Economics of Information Technology, Organization and Productivity: Theory Development and Empirical Investigation. Award: \$309K (6/98-10/04)

Principal Investigator. Customer Behavior in On-Line Markets. Wharton Electronic Commerce Forum. Award: \$25K (6/00 – 6/01).

Principal Investigator. Switching Cost and Pricing in Electronic Markets. Wharton eBusiness Initiative. Award \$25K (6/01-6/02)

## **Journal/Conference Reviews**

### Editorial Board

Information Systems Research (Guest Senior Editor, 2009-2011; Senior Editor, 2007-2008; Associate Editor 2000-2002, 2004 Guest Associate Editor)

Journal of Management Information Systems (2002-present)

Management Science (2002-2008; Departmental Co-Editor – Information Systems, 2008-2015)

SSRN Information Systems and Economics (2004-2008)

### Program Committee

Workshop on Information Systems and Economics (2009 Conference Co-Chair; 2004, Conference Co-Chair)

International Conference on Information Systems (2000, 2003 Associate Editor)

ACM Conference on Electronic Commerce (2007)

International Conference on Information Systems Doctoral Consortium (2007)

NYU CeDER Summer Doctoral Workshop (2007)

### Ad-hoc Reviewer

American Economic Review, Canadian Journal of Economics, Canada Social Science Research and Humanities Council, City University of Hong Kong - Grant Review Committee,

Communications of the ACM, Economic Inquiry, European Economic Review, European Journal of Operations Research, Hawaii International Conference on System Sciences

Industrial Relations, Industrial and Labor Relations Review, Information Economics and Policy, Information Systems Frontiers, Information Systems Research, Information Technology and Management, Journal of Banking and Finance, Journal of Industrial Economics, Journal of Law,

Economics and Organization, Journal of Management Information Systems, Journal of Organizational Computing, Journal of Productivity Analysis, Management Science, Managerial and Decision Economics, Manufacturing & Service Operations Management, Marketing Science, McGraw-Hill Textbook Division, MIS Quarterly (occasional Guest Associate Editor), National Science Foundation, Review of Economics and Statistics, Regional Science, Sloan Management Review, Quarterly Journal of Economics

## Teaching Experience

Massachusetts Institute of Technology, Sloan School of Management. Course: 15.567 – Introduction to eBusiness, Fall, 2001 (2 sections, co-taught with Erik Brynjolfsson)

University of Pennsylvania, The Wharton School. Course: OPIM101 – Introduction to Operations and Information Management. Fall, 2007; Fall, 2008; Fall, 2009; Fall, 2010; Fall, 2011 (Co-instructor); Fall, 2012; Fall, 2013 (x2); Fall, 2014 (x2) ; Fall, 2015 (x2) (Instructor).

University of Pennsylvania, The Wharton School. Course: OPIM105 -- Data Analysis in VBA and SQL. Spring, 2011 (Co-instructor); Spring, 2012; Spring, 2013; Fall, 2013; Fall 2015; Fall 2016 x2; Fall 2017 x2; Fall 2018 x2, Fall 2019 x2; Spring 2020.

University of Pennsylvania, The Wharton School. Course: OPIM 469 - Advanced Topics in Information Strategy and Economics. Spring, 2000 (x2); Spring, 2001 (x2); Spring, 2002 (x3) (Instructor); Spring, 2003 (Co-instructor, 2 sections); Spring, 2004; Spring, 2005; Spring, 2006; Spring, 2007; Fall, 2008; Spring, 2010; Spring, 2011; Spring, 2012; Spring, 2013, Fall 2014 (Instructor)

University of Pennsylvania, The Wharton School. OPIM669 - Advanced Topics in Information Strategy/Financial Information Systems. Spring, 1998; Spring, 1999; Spring, 2000; Spring, 2001; Spring, 2002 (Guest Lecturer); Spring, 2003 (Co-instructor); Spring, 2004; Spring, 2005; Spring, 2006; Spring, 2007 (Instructor).

University of Pennsylvania, The Wharton School. Tiger Team Field Application Project. Spring, 1999; Spring, 2000; Spring, 2001 (Faculty Advisor for Electronic Commerce/IT projects)

University of Pennsylvania, The Wharton School. Course: EMTM900 – Electronic Commerce Marketing. Spring, 2000 (Guest Lecturer)

University of Pennsylvania, The Wharton School. Course: D-SEM on Electronic Commerce. Fall, 2000

University of Pennsylvania, The Wharton School. Course: OPIM 319 - Advanced Topics in Information Strategy/Advanced Decision Support Systems (now OPIM469). Spring, 1998; Spring, 1999 (Instructor)

University of Pennsylvania, The Wharton School. Course: OPIM 210 - Management Information Systems. Fall, 1996; Spring, 1997; Fall, 1997; Spring, 1998; Spring 1999 (x2); Fall, 2002 (x2); Spring, 2004; Spring, 2006; Fall, 2006; Spring, 2007; Fall, 2007 (Instructor).

University of Pennsylvania, The Wharton School. MBA Pre-Term Exercise on Contract Negotiations for Information Technology Outsourcing. Fall, 1998; Fall, 1999 (with D. Croson and R. Croson)



University of Pennsylvania, The Wharton School. Course: OPIM 950/955/960/961 - Doctoral Seminar in Information Technology: Economics and Organization. Fall, 1997; Fall, 2000 w/ R. Aron as OPIM899; Fall, 2001 (Guest Lecturer); Fall, 2003 (Guest Lecturer); Spring, 2003; Fall, 2004 (Guest Lecturer); Spring, 2005; Spring, 2008; Spring, 2010; Spring, 2012; Spring 2013 (co-Instructor); Spring, 2015; Spring 2016; Spring 2017; Spring 2018; Spring 2019.

University of Pennsylvania, The Wharton School. Course: WH101 – Business and You. Spring, 2017, Fall 2017, Fall 2018, Fall 2019. (cotaught OIDD Session).

University of Pennsylvania, The Wharton School. Course: OPIM 666 - Information: Industry Structure and Competitive Strategy. Winter Quarter, 1997; Spring Quarter, 1997 (Instructor); Guest Lecturer (Fall Quarter, 1999; Fall Quarter, 2000).

Massachusetts Institute of Technology, Sloan School of Management. Course: 15.566 - Information Technology as an Integrating Force in Manufacturing. Spring, 1995 (Teaching Assistant)

Brown University, Department of Engineering. Course: EN 162- Analog Circuit Design. Spring, 1987 (Teaching Assistant)

### **Professional Affiliations**

Sigma Xi, Tau Beta Pi, Association for Computing Machinery, American Economic Association, INFORMS, Association for Information Systems

### **Students Supervised**

#### *Dissertation Supervisor*

Eli Snir (2001): Lecturer, Washington University  
 Pei-Yu (Sharon) Chen (2002): Professor, Arizona State University  
 Guodong (Gordon) Gao (2005): Associate Professor, University of Maryland  
 Xinxin (Mandy) Li (2005): Associate Professor, University of Connecticut  
 Prasanna (Sonny) Tambe (2008): Associate Professor, Wharton School  
 Fujie Jin (2016): Assistant Professor, Indiana University

#### *Thesis Reader*

Bin Gu (2002): Professor, Arizona State University  
 Il-Horn Hann (2000): Professor, University of Maryland  
 Michael Jacobides (2000): Professor, London Business School  
 Jeff McCullough (2005): Assistant Professor, University of Minnesota  
 Ying Liu (2006): Assistant Professor, University of Hawaii  
 Ben Powell (2003): Unknown  
 Michael Row (2001): Private Industry  
 Baba Prasad (2003): Unknown  
 Mei Xue (2001): Associate Professor, Boston College  
 Matt Thatcher (1999): Assistant Professor, University of Nevada (Las Vegas)  
 Shinyi Wu (2003): Assistant Professor, Arizona State University  
 Moti Levi (2001): Private Industry  
 Antonio (Toni) Moreno-Garcia (2012): Assistant Professor, Northwestern University  
 Sergeui Roumanitsev (2006): Private Industry



Marcelo Olivares (2007): Associate Professor, Columbia University  
 Ben Shiller (2011): Assistant Professor, Brandeis University  
 Adam Saunders (2011): Assistant Professor, University of British Columbia  
 Fangyun (Tom) Tan (2011): Assistant Professor, Southern Methodist University  
 Vihbahshu Abhishek (2011): Assistant Professor, Carnegie Mellon University  
 Hessam Bavafa (2013): Assistant Professor, University of Wisconsin  
 Yili (Kevin) Hong (2013): Assistant Professor, Arizona State University  
 Dokyun Lee (2014): Assistant Professor, Carnegie Mellon University  
 Jing Peng (2015): Assistant Professor, University of Connecticut  
 Bowen Lou (2019): On academic job market

#### *Other Doctoral Advising*

Fujie Jin (2013): Summer Paper Advisor, Primary Academic Advisor  
 Amanda Jensen (2010): Summer Paper Advisor  
 Felipe Csaszar (2005): Academic Advisor  
 Ozge Yapar (2015-6): Independent study supervisor  
 Kayoung Choi (2015): Summer Paper Advisor  
 Etiye Cansu Erol (2019): Summer Paper Advisor

#### *Masters Students*

Xiaoge Zhou, OPIM Department, Wharton School (1999-2001): Thesis Supervisor  
 Jihae Wee, School of Engineering and Applied Science (2003): Project Supervisor  
 Zhu Lu, College of Arts and Sciences (2014): Thesis Supervisor

#### *MBA Students*

Anna Blaczyck, Wharton School (2004): Independent Study Project Supervisor  
 Luca Coltro, Wharton School (1997-1998): Advanced Study Project Supervisor  
 Andrew Trader, Wharton School (1999): Advanced Study Project Supervisor

#### *Undergraduate Students*

Steven Altman, Wharton School (1997): Independent Study Project Supervisor  
 Maury Apple, Wharton School (1997): Independent Study Project Supervisor  
 Tara Bhandari, Wharton School (2002): Society Project Supervisor  
 Thomas Burrell, Engineering School (2001): Senior Project Supervisor  
 Todd Bishop, Wharton School (1999): Independent Study Project Supervisor  
 Rachel Boim, Wharton School (1999): Independent Study Project Supervisor  
 Hope Bromley, Wharton School (2000): Independent Study Project Supervisor  
 John Chiang, Wharton School (2001): Society Project Supervisor  
 Charlene Chen, Wharton School (2005): Senior Design Project Supervisor  
 Robert Dolan, Wharton School (2003-4): Wharton Research Scholars Supervisor  
 Ronak Gandhi, School of Engineering (2013): Senior Design Project Supervisor  
 Gabriel Gottlieb, School of Engineering (2002): Senior Design Project Supervisor  
 Phuong Ho, Department of Economics (1998): Honors Advisor  
 Richard Hooper, Systems Engineering (1999): Independent Study Project Advisor  
 Hunter Horsley, Wharton School (2015): Independent Study Project Advisor  
 Melinda Hu, Wharton School (2018-2019): Wharton Research Scholars Advisor  
 Pawel Hytry, Wharton School (2011-2012): Independent Study Project Advisor  
 Ulhas Jagdale, School of Engineering (2013): Senior Design Project Supervisor  
 Johnny Kong, Wharton School (2005): Senior Design Project Supervisor  
 Amin Laksmiani, Computer Science and Engineering (2010): Senior Design Supervisor  
 Henrique Laurino, Wharton School (2018): Senior Thesis Supervisor

Jacob Lefkowitz, Wharton School (1998): Society Project Supervisor  
 Steven Levick, Wharton School (2012): Independent Study Supervisor  
 Brandon Newberg, Wharton School (2012): Independent Study Supervisor  
 David Perez y Perez, Wharton School (1999): Independent Study Supervisor  
 Nickhil Ramchandi, Wharton School (1999): Independent Study Supervisor  
 Reuben Randolph, School of Engineering (1998): Project Supervisor  
 Kevin Reeves, School of Engineering (2001): Independent Study Project Supervisor  
 Allison Rosen, Wharton School (1997): Independent Study Project Supervisor  
 Jennifer Seo, School of Engineering (2000): Senior Design Project Supervisor  
 Kyle Smith, Wharton School (2001): Independent Study Project Supervisor  
 David Thornton, Wharton School (2005): Senior Design Project Supervisor  
 Jon Turow, Wharton School (2005-6): Independent Study Supervisor  
 Udack Victor, School of Engineering (2000): Senior Design Project Supervisor  
 Jason Wang, Wharton School (1998): Society Project Supervisor  
 Melinda Wang, Wharton School (2018): Senior Project Supervisor  
 Christine Wong, Wharton School (1997): Society Project Supervisor

## **Other Service**

### University of Pennsylvania

Academic Dishonesty Disciplinary Committee Panel (2012)  
 Trustees Committee on Academic Policy (2009-2010)  
 Lindback Teaching Award Committee (1999)

### Wharton School

Curriculum Innovation and Review Committee (CIRC) (chair, 2016-20)  
 Undergraduate Curriculum Evaluation Committee (2014-2016)  
 Management Department Q-Review Committee, Chair (2013-2014)  
 Wharton Personnel Committee (2009-2011)  
 Dean's Advisory Group (2008)  
 Panel Moderator, Wharton Asia Business Forum (2006)  
 Undergraduate Curriculum Design Committee (2003)  
 Ph.D Program Review Committee (2000)  
 Dean's Council on Education (2001)  
 WebI Curriculum Development Committee (2000)

### Wharton School, Undergraduate Division

Moderator, Wharton Information Technology Career Panel (1997-99)  
 Graduation Speaker (1999)  
 Parents Weekend Speaker (1999)  
 Hauck Teaching Award Committee (2000-01)  
 Electronic Commerce Concentration Advisor (2000-present)  
 Wharton/Monitor Corporation Undergraduate Case Competition Judge (2001)  
 Deans Award for Excellence Committee (2010, 2006)

### Wharton School, Department of Operations and Information Management/OIDD

Recruiting Committee (2005, 2006, 2011, 2014, 2016)  
 Doctoral Admissions Committee (2004, 2005, 2011, 2012-13, 2015-7)  
 Department Q-Review Committee (1999-00)  
 Undergraduate Coordinator (1998-01, 2002-2008)  
 Undergraduate Curriculum Committee (1998-01, 2002-2008)  
 Department Computing Coordinator (1997)  
 Department Representative to Wharton Computing (1997)  
 Department Seminar Coordinator (1996, 2010)

Departmental Tenure Committees (2006, 2013, 2014, 2019)  
Wharton School, Public Policy Initiative  
    Wharton/OSET Foundation Project on the Voting Technology Industry (2016)  
Morgan State University  
    Advising on Curriculum Design (2019).  
MIT Center for Coordination Science  
    Seminar Coordinator (1994)  
National Science Foundation  
    Panelist (1998, 2001, 2003, 2005, 2006, 2015)  
    Participant in the NSF CISE/SBE Cyberinfrastructure Workshop (2005)  
International Conference on Information Systems  
    Doctoral Consortium Faculty (2006)  
Other  
    MIT Inclusive Innovation Competition Judge (2016)  
    NYU/CeDER Summer Doctoral Consortium Faculty (2006)